MANAGEMENT, TECHNOLOGY, AND STRATEGY

FOR SMALL SYSTEMS

INPUT

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MANAGEMENT, TECHNOLOGY, AND STRATEGY FOR SMALL SYSTEMS

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MANAGEMENT, TECHNOLOGY, AND STRATEGY FOR SMALL SYSTEMS

ABSTRACT

This report is the fourth (and last) of the small systems module of the 1983 U.S. Field Service Program and provides a strategic overview of small-systems service trends, packaging, distribution, and competition.

Technological developments affecting small systems are discussed, including developments by H-P, IBM, DEC, Data General, and Basic Four. Small-systems service management developments are analyzed, particularly new service products like time-of-day and day-of-week coverage.

Finally, a substantial portion of the report is dedicated to tactical and strategic conclusions and recommendations, including pricing, efficiency/allocation of services, delivery mechanisms, and improved resource control.

This report contains 114 pages, including 22 exhibits.

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1983

MANAGEMENT, TECHNOLOGY, AND STRATEGY FOR SMALL SYSTEMS

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MANAGEMENT, TECHNOLOGY, AND STRATEGY FOR SMALL SYSTEMS

EXHIBITS

1 INTRODUCTION

I INTRODUCTION

A. SCOPE

- As a result of significant changes taking place in the small-systems market, service management is faced with a number of challenges. These challenges stem from:

  - Increasing competition from networked-based personal computers as an alternative to small systems.

  - Growing reliance of users on small systems, requiring faster response and repair times.

  - The increasing importance of software support.

  - End users' increasing emphasis on service cost containment, responsiveness, and quality.

- Service is becoming both technologically intensive and more competitive. Thus, service managers supporting small systems must become more innovative and sophisticated. They must deliver cost-effective and responsive service by efficiently controlling all service resources (i.e., personnel, parts, and data) in response to changing customer needs and requirements.

- For the third-party maintenance organization, the small-systems market is an opportunity that is becoming more challenging as it becomes more technologically complex, involving both hardware and software support and constant competition.

B. METHODOLOGY

- This report is based on INPUT's assessment of the trends and technology developments that are discernible in the U.S. marketplace today. No specific research, either user-oriented or vendor-oriented, was accomplished. Instead, the accumulated knowledge of the research carried over in calendar 1983 on small-system customer service topics has been condensed in this volume.

- Comparison reports on the service aspects of large systems, peripherals and terminals, and office products are also available. Client comments on the usefulness and content of this report are welcomed, particularly concerning the scope and conclusions found herein.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. INTRODUCTION

- This Executive Summary is designed to help the busy reader quickly review the research findings of this report without having to read each section, while ensuring that the key points are not missed. Each main point is summarized as an exhibit, and an accompanying script is given on the facing page.

- The small-systems market has always been an area of rapid change in product price/performance and an area of high competition. This was true with the minicomputer revolution, which attacked the established market for small business systems, and is once again true with the microcomputer revolution, which has redefined acceptable price/performance ratios for each level of small system.

- Service, as a key component of product image, reliability, and quality (as well as an integrated part of evaluations of the cost of ownership) has received increased emphasis at the hardware level - but not at the software level. In the coming year software quality, reliability, and service response times to software problems/failures will be a focus point for small-system vendors anxious to provide competitive total systems availability.

B. SMALL-SYSTEMS AND MINICOMPUTER MARKETS

- The market for small systems has slowly separated into four separate submarkets with their own special system, application, and service needs. They are:

  - Small systems under $15,000 (excluding personal computers; treated in INPUT's office systems report). These are the so-called "naked" minis, which are sold to OEMs and system integrators and which are generally not supported or serviced directly by the manufacturer.

  - Standard small systems ($15,000 to $100,000). The traditional SBS market growth rate is slowing due to heavy competition from microcomputer vendors and minicomputer alternatives; price competition is strong and service image and quality are paramount in closing a purchase decision.

  - Special application small systems. These include the many vertical-market, special-purpose products that compete only in their narrow market niches and not across markets; examples are the Computer Consoles products (computerized directory assistance systems), C3 Inc.'s customized defense and other government turnkey systems, the many CAD/CAM systems, HBO's hospital information systems, etc.

  - Supermini systems (formerly the top range of small systems, now a part of large systems). Generally 32-bit minicomputers with small-to-medium mainframe capabilities that now compete directly with mainframe products for mainframe markets. Companies include DEC, Prime, DG, Pyramid, Floating Point Systems, Gould, and others.

EXHIBIT II-1

SMALL-SYSTEMS AND MINICOMPUTER MARKETS

SEGMENT	1983 SALES ($ BILLIONS)	1983 SERVICE REVENUE ($ MILLIONS)
1. Small Systems Under $15,000	$1.05	$580
2. Standard Small Systems ($15,000 to $100,000)	1.50	900
3. Special Application Systems (e.g., CAD/CAM Computer Consoles, Gerber)	1.25	625
4. Superminis/ Largeminis	1.63	720
Total	$5.43	$2,825

= Part of Large-Systems Market Move.

Note: Excludes Office Products and Personal Computers

C. SMALL-SYSTEMS SERVICE TRENDS

- The fact that all of the categories mentioned in section II.B have experienced a recent sharp increase in the reliability of all products is evident in hardware. This has brought out a number of new service commitments relating to guaranteed availability, 99% uptime, guaranteed response, user self-maintenance options, and single-source maintenance.

- Unfortunately the same commitment to quality and response on software product service has so far not been in evidence. As a result the user is slowly perceiving the disparity between software support levels and hardware support levels and will shortly place demands on the vendor community to drastically improve support in terms of response time, repair time, and service delivery method.

- INPUT believes it is crucial, at this point, for vendors to do the following:

  - Expand the number of software service options (levels of service) available to the end user.

  - Increase basic monthly maintenance prices for software to provide the revenue to support the above.

  - Target system availability, not hardware availability.

  - Put software support on-line, both for support center queries and downline loading/distribution of software fixes.

- This applies to all of the categories of small systems mentioned in Section II.B (with the exception of the supermini category, which must compete with more complex and demanding mainframe system environments). Automation of software support and service price increases are the keys to retaining a profitable service operation.

EXHIBIT II-2

SMALL-SYSTEMS SERVICE TRENDS

- Increased Reliability
- Increasing Ease of Diagnosis, Recovery
- Guaranteed Availability, Usually at No Extra Cost,That is Becoming a Standard Offering
- Software Reliability (and Response Time) More Visible Due to Hardware Improvements in Same Areas — User Dissatisfaction Has Resulted
- Software Maintenance and Support Needs to Be Put On-line

D. SERVICE PACKAGING ACCORDING TO DISTRIBUTION CHANNEL MIX

- The large number of specific distribution channels open to the small-system market is covered in detail in Exhibit III-5 and specifies the rate of growth of business through each channel. Each channel requires a separate and equally specific package of support and service, customized for the special needs, capabilities, and requirements of the dealers, distributors, office dealers, and OEMs/VARs involved.

- A larger and larger percentage of these small-system sales outlets require only over-the-counter parts and OEM-type support, with their own service provided to the end user. These include:

  - Systems integrators.

  - Industrial system distributors.

  - Some OEMs.

- INPUT believes that this trend will continue, with many retail store chains taking on the responsibility for end-user service.

- Third-party maintenance firms are likely to be aggressive in this regard, and are capable of coming to an agreement with the office system dealers and other retail chains for nationwide support of entire lines of products.

- This could have the short-term effect of reducing the product manufacturers' service revenue substantially, while increasing the gross margin on operations (since much of the business would come from over-the-counter parts - a high-margin contributor). The essential need is for the product manufacturer to closely monitor the overall response received by the end user, so that good product image is maintained.

EXHIBIT II-3

SERVICE PACKAGING ACCORDING TO DISTRIBUTION CHANNEL MIX

- As Distribution Channels Increase in Number and Type, Specific Service Packages are Needed to Support Each One:
  - Retail Stores
  - Industrial System Distributors
  - Independent Office System Dealers
  - OEMs/VARs
  - Branch Offices and Other Direct Sales Channels
- Need to Monitor Overall Response as Perceived by the End User, Rather Than Service to Intermediaries

E. INCREASED COMPETITION FOR SMALL SYSTEMS MAKES SERVICE IMAGE VITAL

- The small-systems market will continue to separate into niche markets along the lines of application needs. This will intensify competition for each sale. In addition, microcomputers (particularly multiuser systems) will rapidly develop capabilities equivalent to the average small business system - at less than half the price.

- Of paramount importance is the ability of the customer services organization to respond to increased competitive pressures with marketable, realistic service packages that are price competitive and responsive to the end user. In order to do that it is important to note that it is no longer possible to price service as a percentage of purchase price: the hardware price reductions have eliminated that method.

- The driving forces behind service packaging and pricing have to be:

  - End-user requirements (as to level of service, delivery method, responsiveness, source of service, etc.)

  - End-user expectations (as to what is reasonable in pricing, contractual obligations, user/vendor interfacing).

  - Service quality (compared to competition).

- This is a classical marketing exercise starting from requirements, running through competitive analysis, and moving on to a creative packaging of the vendor's service capabilities to match needs. Vendors that are most imaginative and responsive in their service offerings will find their small-system sales potential greatly strengthened.

INCREASED COMPETITION FOR SMALL SYSTEMS MAKES SERVICE IMAGE VITAL

- End Users' Cost of Ownership of Small Systems Now Integrates Software and Hardware Service Charges
- Service Pricing Based on Percentage of Purchase Price No Longer Valid - Determined By Service Quality and User Needs
- End Users' Expectation Grows That Service Productivity Tools/Delivery Mechanisms Should be Reflected in Lower Service Costs. Service is an Integral Part of In-Field Product Image

III TECHNOLOGY AND PRODUCTS

III TECHNOLOGY AND PRODUCTS

A. INTRODUCTION

- The start of the boom in the small computer systems market was largely related to the establishment of Digital Equipment Corporation (DEC) in 1957. DEC was organized to develop small computers or "minicomputers" to satisfy scientific and technical markets. The computers they produced were sophisticated and able to use raw computer power directly, without the full support (and cost) that the large mainframe manufacturers (such as IBM, Burroughs, Univac, and Honeywell) were providing to business users. This proved to be a rapidly growing market without any real competition.

  - Other start-up firms, such as SDS, Modcomp, Data General, Datapoint, Prime, and Microdata, soon successfully followed DEC, and the small-systems market was underway. Nevertheless, this market segment changed significantly during the 1960s and 1970s - from primarily stripped-down technical/engineering and process-control-oriented units to full systems. In essence, there are now three types of small-systems vendors/products:

  - Stripped, hardware-only minicomputers - used primarily by OEMs, systems integrators, and technical personnel to develop their own systems (e.g., Varian, General Automation).

- Standard small systems - providing hardware and software to meet small users' general needs (e.g., DEC, Data General, Datapoint, Hewlett-Packard, Texas Instruments, and small systems from the large mainframe manufacturers such as IBM, Burroughs, Honeywell, and NCR). These systems are increasingly being sold to selected vertical market segments, as a result of niche-oriented or applications-oriented software made available to support the hardware.

- Supermini systems - providing direct competition to large/medium mainframe systems and aimed at that portion of the general-purpose market that does not require very large computing, data storage, and telecommunications capacity at one central location (e.g., Data General, DEC, Prime).

- The small-systems market in the U.S. in 1983 was valued at approximately $5.5 billion in shipments and is projected to grow to over $8 billion by 1985. The major growth is in the supermini market, followed by standard small systems in the $15,000-100,000 price range, sold to specific market segments. The size of this market through 1983 and market forecasts through 1985 are shown in Exhibit III-1. In general, each of these segments/product areas requires different types and levels of support and assistance, and has different competitive positions and trends. The growth trends of these four subsegments of the small-systems market are illustrated in Exhibit III-2.

- The dollar value of shipments of small computer systems, which grew at an annual rate in excess of 40% in the late 1970s, has slowed over the past few years, and this slower growth is expected to continue. As indicated above, U.S. shipments of small computer systems amounted to approximately $5.5 billion in 1983, up 8.4% over 1982. Only a 6.2% growth increase is estimated for 1984. It is estimated that the growth of small computer systems will average only 9.5% annually between 1983 and 1986.

EXHIBIT III-1

U.S. SMALL BUSINESS SYSTEMS SALES

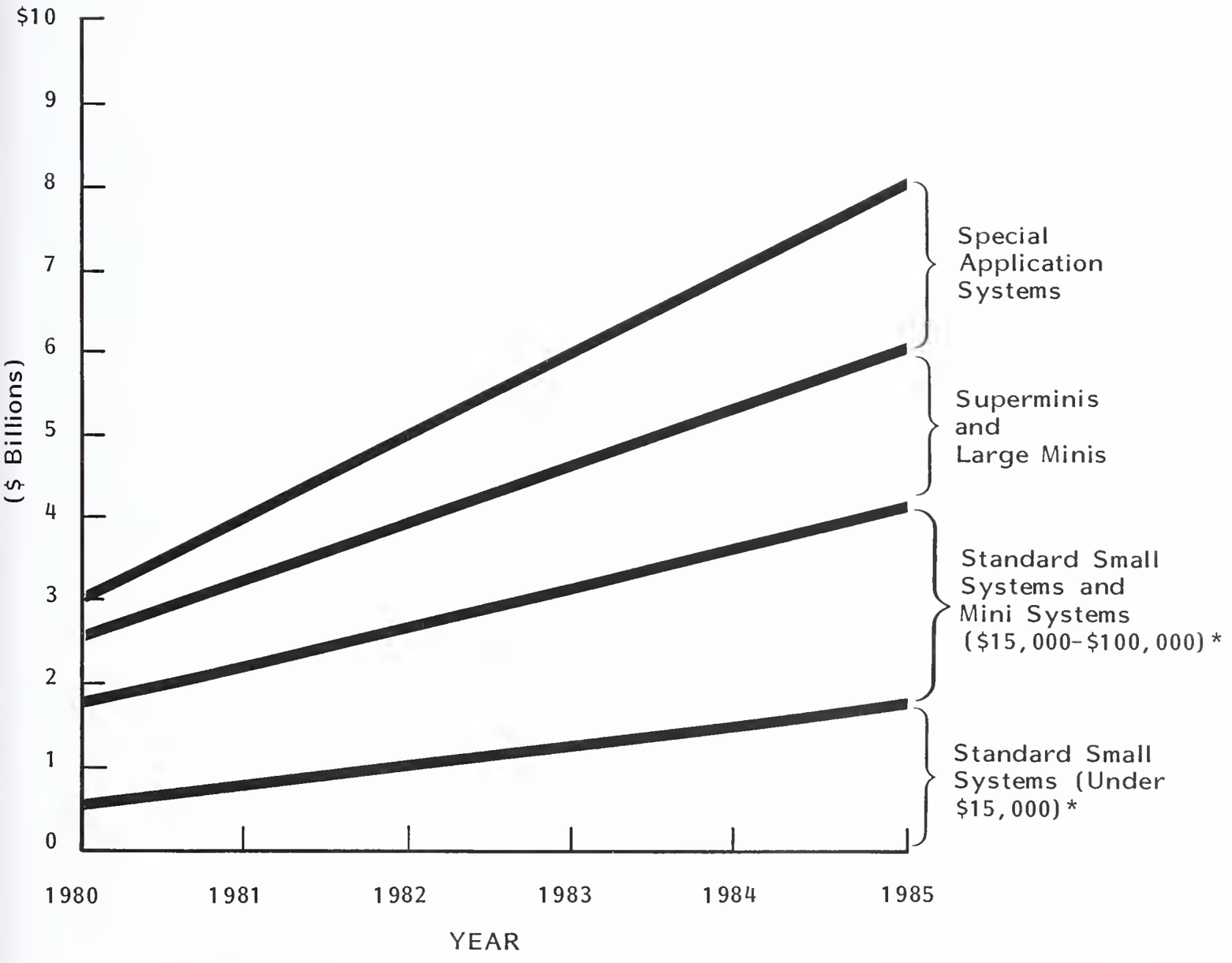


EXHIBIT III-2

STRUCTURE OF SMALL-SYSTEMS MARKET

TYPE OF SYSTEM	TYPICAL VENDORS	KEY TRENDS AND COMPETITIVE ISSUES	KEY DISTRIBUTION AND SERVICES SUPPORT ISSUES
Supermini Computers	DEC, Data General, Gould, Prime, Pyramid	• High growth rate • Increasing competition with mainframes on price/performance basis.	• Sold direct to end-users • Requires full service and support capability – equivalent to mainframe support.
Standard Small Systems	IBM, NCR, Burroughs, Datapoint, Microdata, Honeywell, Hewlett-Packard	• Growth rate slowing • Heavy price competition • Direct performance competition from both high-end (superminis) and low-end (personal computers)	• Sold directly to end-users and indirectly through distributors and retail stores • Quality and responsiveness of service vital. • Service is becoming critical in purchase decision
Special Application Small Systems	Computervision Autotrol, Applicon Reynolds & Reynolds ADP C3 Gerber HBO Computer Consoles	• Medium growth rate due to continuing needs for special applications • Competition primarily from software operating on standard systems	• Sold direct to end-users • User highly dependent on system and needs both hardware and software support • Remote technical assistance becoming a critical factor
Stripped/ Naked Minis	Varian, General Automation, Intel	• Medium growth rate • Becoming essentially a commodity market	• Sold direct to OEMs and systems integrators • Service and support generally not provided by manufacturer

- This projected slowdown in the purchasing of small systems is a result of both price/performance improvements and increased market competition. Poor business conditions and high interest rates have slowed capital spending by MIS departments, which have offered users required services via timesharing and remote computer processing to large, presumably more cost-effective central host processors, which MIS departments could effectively control and manage.

  - This approach increasingly frustrated users, who could not get what they needed without approval and review by the centralized MIS organization. Thus, users began to turn to an economically feasible (i.e., within their purchasing authority) alternative, the personal computer, which they could acquire, manage, and control.

  - In essence, technological competition from smaller systems (PCs) and larger systems (network-host-based technology) has affected the small systems' growth potential. In essence, competition has inhibited growth in dollar volume of the small computer, not only by keeping prices down to maintain cost-effective rates, but also through a "vertical or replacement competition."

  - In summary, supercomputers based on network systems are squeezing the small computer system market from above, while more powerful desktops and personal computers that can handle some of the small business requirements are squeezing it from below.

- This market is expected to improve with the pickup in worldwide economies over the next couple of years; however, the 40% annual growth rate of the 1970s will not return, as competition is likely to continue to restrict growth.

- Leading manufacturers in the small computer market include IBM, Digital Equipment, Data General, Hewlett-Packard, and Burroughs; most of these firms are also important manufacturers of other types of office equipment. Estimated market shares, by vendor, are shown in Exhibit III-3.

EXHIBIT III-3

SMALL BUSINESS SYSTEMS VENDORS' MARKET SHARES

VENDOR	ESTIMATED MARKET SHARE
IBM	28.3%
DEC	15.5
Hewlett-Packard	9.5
Honeywell	5.1
Data General	4.2
Burroughs	3.9
Texas Instruments	3.3
NCR	3.2
WANG	3.0
PRIME	3.0
Datapoint	2.1
Other	19.4
TOTAL	100.0%

- Total worldwide shipments of small computer systems by U.S.-based manufacturers are expected to increase at an annual rate of 20% between 1983 and 1986. For 1982, however, only a 16% increase is estimated. The large OEM (original equipment manufacturer) market has been particularly weak due to the poor economy and high interest rates. High interest rates affect OEMs because OEMs buy machines on credit and must finance them until they are sold.

- Longer term growth in the small-systems market should continue to be fueled by the increasing use of superminicomputers, which garnered 18% of unit shipments of the total small computer systems market in 1983.

  - Superminis, which are generally 32-bit systems, are projected to grow at a compound annual rate of 30% to 40% in dollar terms through 1986.

  - On the other hand, the traditional minicomputer sector - older 16-bit systems - should be about flat through 1986. This traditional segment is continuing to lose business to the superminis, which offer greater computing power.

  - Superminis are also gaining customers from the low-end large mainframe system market. The trend toward distributed data processing gives superminis a distinct advantage over mainframes. Superminis, once bought only by the scientific market, now are also finding applications in the commercial markets, which should provide healthy growth. Newer uses include CAD (computer-aided design) and office automation, both fast-growing markets.

- In summary, the small-systems market is large and growing. Nearly four million small computers (priced at more than $5,000 but less than $100,000) will be sold during the 1980s, and more than 75% of them will sell for less than $10,000. By 1990 U.S. small business will have spent approximately $50

billion on small computer systems. Of this total, $35 billion will go toward hardware and systems software, and $15 billion toward applications software.

B. GENERAL TRENDS IN SMALL SYSTEMS

- Several general product trends in small computer systems can be observed. These include a shrinking in computer size, a decline in hardware prices, an increase in computational and software capability, and an incrase in the number of vendors. A general trend in the minicomputer segment of the small-systems market is a move to a 16-bit machine, versus the old 8-bit. The 16-bit computer allows more computing power, which is especially useful in the business/professional and scientific markets. Some of the 16-bit makers include Digital Equipment, Wang, IBM, and Tandy. The increasing number of new vendors is not expected to last, and a gradual shakeout is likely to occur over the next few years.

- The standard small-systems market is becoming highly price and performance competitive, and service is becoming much more important. However, the ability to deliver responsive, cost-effective service is becoming more difficult.

  - The smaller firms do not have the service force size and installed base density to provide appropriate responsiveness, and their markets have thus become targets for third-party maintenance organizations.

  - While the large mainframe firms have the installed base and density, they have not, in general, developed specific strategies and service targets to meet the needs of the small-system user. In the special applications small-systems markets, the specific software and application needs and requirements have not been fully satisfied.

- Small and minicomputer systems are also undergoing a significant challenge due to the increasing use of personal computers. In essence, the primary difference between clustered personal computers and small and minicomputer systems is software; an increasing number of small systems are sold by packaging hardware and software to meet specific horizontal or vertical market segment applications. This has resulted in some significant changes in marketing, distribution, and service requirements.

- Previously, the primary market for small computers and minicomputers was sophisticated customers: scientists, researchers, and OEM manufacturers that developed their own fully integrated systems. Today, an increasing number of small systems are sold to first-time users: relatively unsophisticated customers requiring different marketing, distribution, service channels, and levels of support.

- Many small-systems vendors have not recognized these changing needs. For example, many of the standard small-systems manufacturers have yet to put together fully integrated small-systems product lines to serve the unsophisticated user. A number of different types of firms without a strong orientation toward the unsophisticated end users' needs are attempting to move into the small-systems market, including both semiconductor companies moving up into the systems market (i.e., Intel) and personal computer firms.

- Users are more concerned than ever before with the question of which type of system represents the most cost-effective solution and which system will best facilitate expansion to meet future requirements. The gaps in performance between yesterday's minis and today's microcomputers have closed to the point where there are real doubts in the minds of even experienced systems analysts as to which type of system will best suit corporate needs.

- Within the last year, a new breed of microcomputer system has appeared that can effectively compete with minicomputers in almost all phases of performance. Micros, now offering 16-bit word length, will soon have 32-bit word length, making them roughly comparable in architecture to the standard minicomputer. Micros have been steadily advancing in utility and desirability, and their prices have been steadily falling, as the latest large-scale integration developments begin to reach the end user. New peripherals, including quad floppies and faster printers, are becoming available; vast amounts of external memory are now offered on hard disk to accompany micros. In addition, micro software is finally beginning to approach the maturity of that offered for minis. Finally, micro system vendors are beginning to recognize the importance of good, reliable service organizations.

- Defining the trade-offs between a mini and a micro from the point of view of a potential user/customer is not easy: the engineering technologies of the two types of devices are overlapping more and more. There are, however, certain real distinctions.

  - Price - although the capabilities of minis and micros overlap, minis generally cost more.

  - Speed and capacity - minicomputers are generally faster, have more memory, and can control a larger number of different kinds of terminals and peripheral equipment.

  - Software - minis generally have greater variety and capabilities; however, this gap is closing.

  - System response time - response is generally faster for mini systems, particularly if the application software is not efficient or has a high rate of I/Os.

- Accuracy - generally the micro offers substantially less precision than the mini or supermini. This can be important in engineering and technical applications.

- Service - generally, service quality and responsiveness are higher from mini systems vendors.

- In general, as product technology from micros and mainframes becomes more competitive and prices erode, end-user-oriented service will become a critical factor in the end user's purchase decision.

C. NEW DEVELOPMENTS IN SMALL SYSTEMS

1. INTRODUCTION

- The history of the minicomputer and small system has been characterized by steadily improving price/performance ratios: more performance for the same price and equivalent performance at reduced price. Given the expanding market for mini-based products, there is every reason to expect that this trend will continue.

  - The downward migration of mainframe-based software will continue, and the advances in packaging will also continue, putting more and more power into user stations.

  - One trend, barely under way, is toward fault-tolerant systems. DEC is reportedly working on a fault-tolerant, VAX-based minicomputer line.

  - Some vendors offer hardware features that enhance maintainability. For example, the CA Naked Mini Scout includes a diagnostics function called Isolite that automatically tests and identifies any malfunctioning boards.

- Still another approach just getting off the ground is the local-area network concept for small systems. Baseband and broadband systems are competing to determine which technique will prevail. Most minis will provide interfaces to the surviving networks for office automation and other business-based applications.

- While communications is a more difficult problem for small systems that network their capabilities, networks will require standardization among vendors. Some standards are emerging: the CCITT X.25 recommendation for packet-switched communications seems to be gaining support, and more and more minicomuter vendors are equipping their machines to talk with IBM mainframes or fit into IBM's Systems Network Architecture (SNA).

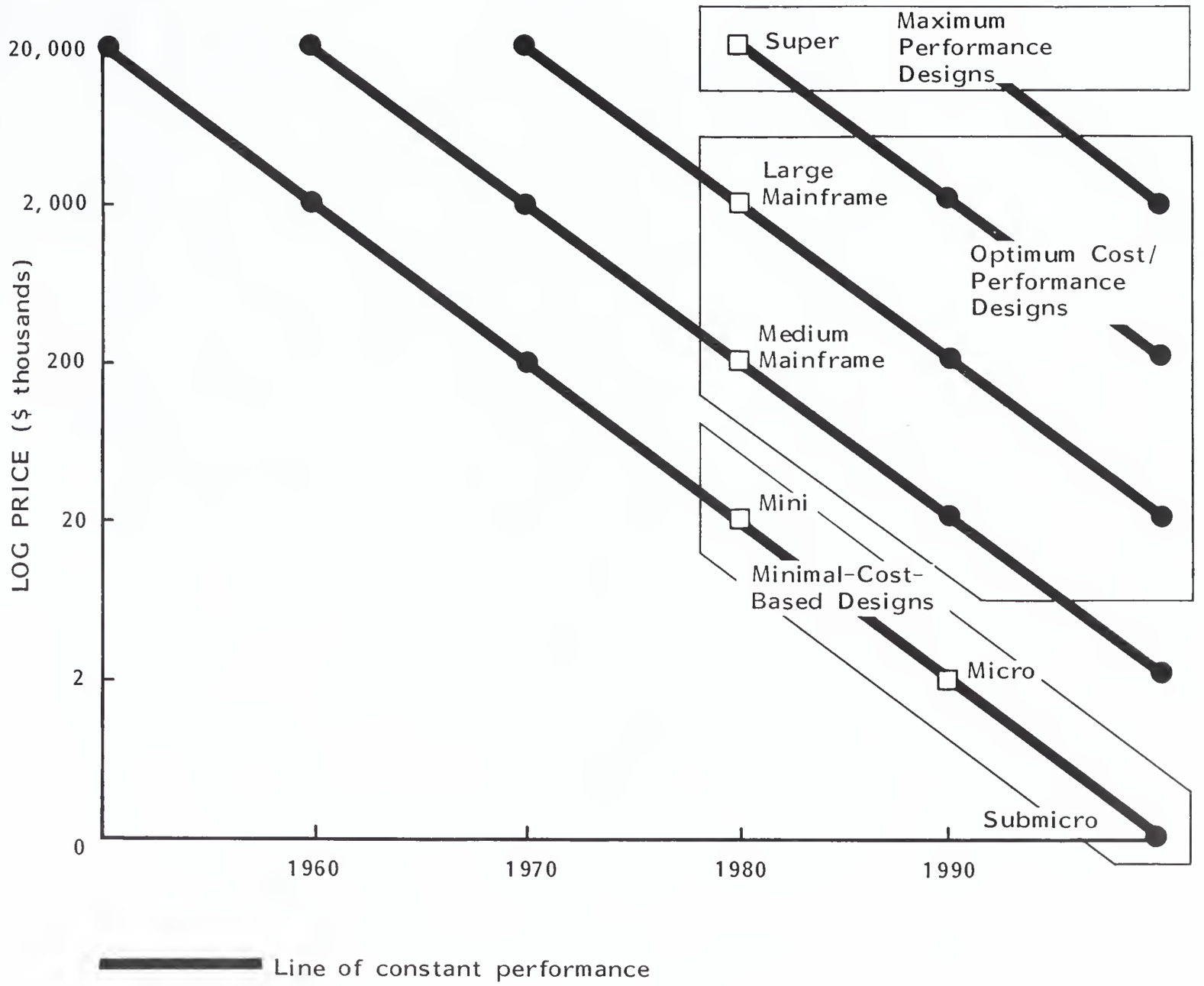
- Digital Equipment recently extended its support of the X.25 implementation with its VAX-11 PSI protocol. Honeywell's recent addition to its Distributed Systems Architecture connects its products to the X.25-based networks. Data General's Xodiac networking product is compatible with X.25 systems, as is Prime's Primenet. Small systems from Honeywell, Data General, Harris, Hewlett-Packard, and Wang also connect with SNA systems.

- In general, as shown in Exhibit III-4, new small systems provide better performance than earlier machines at the same price (see horizontal arrows) or the same performance at low prices (diagonal lines). In essence, each new small system class adapts to the performance level that was initially realized by its predecessor one time interval earlier.

- Following the introduction of each new class, improvements in function and performance are made as technology advances, without changing the price range of the computers in the class. To understand the notion, consider that the performance of today's microcomputers easily matches or surpasses those of the earliest "super" computers in the 1950s, and that their prices are three

EXIBIT III-4

PRICE/PERFORMANCE COMPUTER DEVELOPMENT AND EVOLUTION



to four orders of magnitude lower (note that the vertical scale in Exhibit III-4 is logarithmic).

- Today, all 8-bit CPUs sell for less than $5,000 and are called microcomputers, while the new 16-bit microcomputers have usurped the low end of the 16-bit minicomputer market. Small CPU system class definitions, then, are not hard and fast, but vary with time. In this regard, it is important to recognize that system vendors agonize over whether to characterize each new product as a mini or a microcomputer because the designation affects the positioning of the device in the market. Thus, Hewlett-Packard Company named the A600, one of its two newest entries in the HP-1000 series, a full-function microcomputer, while it calls the other, the A700, a minicomputer.

- These distinctions are based on selling price, not on the level of performance or the fabrication technique of the boards that comprise the CPU. Thus, a minicomputer can be based on large-scale integrated technology, and a microcomputer can be built with medium-scale integrated components.

- At the upper end of the minicomputer scale lie the superminis, which have effectively replaced the "midi" computers (a term that never caught on). Today's superminis are 32-bit machines, selling for $50,000 to $300,000. The Perkin-Elmer Corporation 32 series, the Gould S.E.L. 32 series, the DEC VAX-11s, and the DG MV/8000 16-bit machine selling for $5,000 to $50,000, occupy the middle ground between microcomputers and superminis.

- Some industry observers see the minis caught in a technological and marketing squeeze between increasingly powerful microcomputers and less and less expensive mainframes. But the mini vendors feel their products hold a secure - and growing - position in business. The mini's strength lies in its versatility, ease of use, and networking capabilities. While micros are delivering the first two characteristics to individuals in dramatic fashion, the power of the minis allows them to link dozens, and even hundreds, of users who can share information and communicate through the sytem. Most observers see the situation

changing over that time period, however, with minis and micros converging in capabilities and prices.

- There appears to be little difference, from a technological standpoint, between the new products coming from microcomputer vendors and those introduced by minicomputer vendors.

  - Price differentials are disappearing: network-based microcomputer configurations in the $30,000-60,000 range are now becoming available based on tying micros together into local networks (in essence, the "office of the future" concept has turned into "local-network-based distributed systems" for the small system business user).

  - It is clear that the mini and micro labels for small systems will begin to disappear. At the upper end of the power spectrum, the minis are invading traditional mainframe markets.

  - The minicomputer's ease of use and communications features fit the information processing needs of many small businesses, organizations, and departments within larger operations. The mini's price tag fits departmental budgets, and its size and design fit right in with office furniture. In all, the mini is well suited to carry sophisticated processing and communications power to the office.

  - Meanwhile, manufacturers continue to perfect the specialized scientific and industrial uses for which minis were originally designed.

- In essence, in the small-system price range, many organizations tend to be operated and controlled by the end users. There are compelling reasons for doing so. At the department level, operational goals are obvious to individuals. Programs controlled at the local level provide a tight relationship between the business problem and the data processing solution.

- Packaged software and programs written or adapted at the local level also help the user avoid data processing department backlogs. It is estimated that 70% of backlogs consist of small applications programs that most users could develop themselves, thanks to the new friendly features available on the minis. The 32-bit small systems, in particular, have the capacity to support high-level languages and programming aids that give the computer novice considerable control over the systems. DEC's VAX-11 Datatrieve, for example, interacts with a user or follows a program to locate and report on any data in the system.

2. EVOLUTION OF SMALL-SYSTEMS HARDWARE

- The first minicomputer, the Digital Equipment Corporation's PDP-1, introduced in 1959, had 28 instructions, an 18-bit word length, and 4K words of memory. Today, a high-end 16-bit mini such as the Honeywell Information Systems' DPS 6/76 addresses as much as 2M bytes of main memory, has as many as 28 registers, and works with 184 instructions.

  - The Data General Corporation's Eclipse M/600 has a mainframe-like architecture, with separate processors for I/O and job execution.

  - Hewlett-Packard Company's A700 goes a step further: it may be the first 16-bit machine with virtual addressing, allowing programs to access as much as 12.6M bytes of storage. The A700 also executes as many as 450,000 floating-point operations per second (2.2 μsec. per operation) with its optional computation-acceleration processor board.

  - By way of contrast, Computer Automation's Naked Mini Scout takes 81 to 133 microseconds to execute one of its optional floating-point addition instructions. The Scout is the smallest member of the Naked Mini family, a popular series of OEM minis that spans an order of magnitude or more in processing power, memory capacity, and I/O speeds.

- The availability of such families of minicomputers is vital to OEMs, which need to match CPU capabilities to their applications at the lowest possible cost. OEM minicomputer vendors go to great lengths to give the OEMs as much design flexibility as possible. Memory is incrementally expandable, large processors are software-compatible with smaller processors, and extensions are offered to instruction sets. Several manufacturers provide arithmetic computation options to implement arithmetic operations (when even fixed-point multiplication and division are not in the standard instruction set) or to make them run faster (as in the HP computer acceleration processor).

- A few vendors go still further by furnishing user-microprogrammable CPUs. This feature is aimed squarely at OEMs because microprogramming requires skills that lie beyond the reach of a typical end user's staff. Moreover, microprogramming is a painfully slow process, typically averaging fewer than 1,000 designed, coded, tested, and documented microinstructions per programmer year. These rates compare most unfavorably with typical application programming rates of 3,000 lines of code per programmer year.

- Further, if the 3,000 lines of code are written in a high-level language, they translate into approximately 15,000 lines of machine-level instructions. On the other hand, 1,000 microinstructions translate into fewer than 1,000 machine-level instructions because each machine-level instruction is typically composed of several microinstructions.

- Another capability that has become popular in the larger minis, such as the DEC PDP-11/70 and the CA SyFA 2000, is the use of cache memory. A cache memory is a small (4K bytes is typical) fast memory, usually implemented with bipolar technology, which acts as an adjunct to main memory.

  - The CPU will refer to the cache, with typical access times lower than 100 nanoseconds, before it looks in main memory, with access times of 400 nanoseconds to 1 μ.sec.

- When a word is retrieved from main memory, it is placed in cache for subsequent reference. The "locality of reference" principle for computer programs states that programs tend to use the same data over and over again instead of constantly using new data. Thus, once data is placed in cache, the probability that it will be retrieved from the cache (before being overwritten by another data item) is fairly high.

- The hit ratio - the probability that a given word will be retrieved from cache rather than main memory - can exceed 95% for cache memories of 4K words or more, thereby substantially increasing the throughput of the CPU.

- Computer hardware introduced in 1980 and in the first quarter of 1981 included six 32-bit superminicomputers, which offered the processing power of mainframes at minicomputer prices. These units promise to create new applications and promise to capture a healthy share of the heretofore small computer market.

- At the low end, suppliers continue to develop low-cost products, and a surge of new products is expected this year. Competition at this level is intensifying as small computer systems vendors respond to the marketing challenges posed by personal microcomputers from Tandy Corporation, Apple Computer Inc., and others.

3. EVOLUTION OF SMALL-SYSTEMS SOFTWARE

- In the early days, when minicomputer makers were known only as "iron" suppliers, the only software they provided was an assembler. Users were expected to be technically proficient professionals who could figure out how to program their hardware. The vendors took this approach because they did not have software experts to help users.

- The number of technically proficient users was limited, and many of them were unwilling to spend 80% of their waking hours debugging programs. Since International Business Machines Corporation established a standard for customer service and support, offering software to help users get started, it was only a matter of time before the minicomputer vendors also provided support in this area.

- Today, the availability of complete system software from small system vendors is taken for granted. Assembly language has been supplanted in most applications by such high-level languages as FORTRAN, COBOL, and Pascal; most OEM small-system vendors now offer languages along with sets of utilities for sorting, testing, copying of files, and communication. Every mini on the market includes an operating system that is tailored for the task at hand, whether it is supporting single or multiple users in a real-time, batch, or interactive mode.

- For the most part, the vendor has supplied operating processors. For example, Texas Instruments Inc. provides DS10, a general-purpose disk-based OS for commercial and scientific applications, running on models 4, 7, 8, and 9 of its DS990 minicomputer family. Another TI operating system, called DNOS, is designed for distributed network applications on DS990 models 4 through 30. Like many other vendors, TI supplies a data base management system, a query language, word processing software, and a data entry and display system for the DS990 family.

- Large strides were made in software last year when suppliers began to respond to users' increasing demands for higher powered developmental languages and application packages designed for specific vertical markets.

4. INCREASED RELIABILITY

- Another important trend among small systems and minis is increasing reliability and ease of diagnosis and recovery if a malfunction should occur. Without saying they are working toward the dual processor approach to reliability improvement, the major small-systems and minicomputer vendors express pride in their products' current reliability and say they expect to set even better records in the future. Digital Equipment, for example, plans to "guarantee availability" on its minis "at no extra cost." Hewlett-Packard will refund a customer's monthly service contract fee if one of its 300 series minis falls below 99% uptime.

- Many of the major small-systems vendors offer sophisticated self-testing and remote diagnostics features. These include:

  - Digital's VAX-11/730, offering customer-runable diagnostics, which allow nontechnical users to isolate failing components. Remote hardware monitoring permits service personnel to identify potential problems in the 11/730 from a Digital service center.

  - Data General's Eclipse 8000 contains a separate diagnostics processor that continually monitors performance, logging all "soft" errors and bringing the system down smoothly when it detects "hard" errors. If the system is down, an operator can load microcode from a diskette to initiate special diagnostics routines.

  - Honeywell's remote support capability, TACDIAL, is standard on all DPS 6/92 and DPS 6/96 minis and is now being shipped as an add-on option for other Honeywell machines. It allows on-site and remote interactive diagnosis of hardware and software errors. When Honeywell service personnel work through a diagnostics problem remotely, the on-site operator can follow along on the console terminal, learning the corrective routine should a similar malfunction occur later.

- Hewlett-Packard's HP 3000 minicomputers all offer remote diagnostics. The company says that 90% of failures on the HP 3000 Series 64 can be diagnosed remotely.

- Wang's VS 25 and VS 45 systems run on their bus processors. Remote diagnostics are provided via an 800 number at the company's Corporate Technical Assistance Center.

- BTI 8000s run diagnostic self-tests at startup and identify any nonworking modules on the control panel. Modules failing during operation stop the system. Again, the control panel displays the failed element. Remote diagnostics run via a telephone link to a central service center.

- These and similar developments in maintenance and diagnostics are leading to more and more reliable machines. Some observers believe that reliability of standard minis will soon satisfy the most vital uptime requirements - effectively erasing the special market for fail-safe machines.

5. SUPERMINICOMPUTER DEVELOPMENTS

- A specialized segment of the small computer market is superminis. More than two dozen superminis are on the market, and they are the fastest selling class of small system/minicomputers. Performance levels vary greatly among models, and each supermini vendor advertises price/performance levels based on differently bundled software/process/peripheral configurations. These diverse configurations resulted from the way the supermini market developed - not under the leadership of one vendor, but by the frantically competitve, parallel efforts of many.

- In 1974, Interdata (now Perkin-Elmer Corporation) introduced the 7/32, a 32-bit minicomputer, as an alternative to offering a memory management unit for its line of 16-bit minicomputers. With this decision, Interdata gave birth

to the supermini market. The 7/32 was a pseudo 32-bit computer in that the memory data path was only 16 bits wide, but words as defined by operands, registers, and instructions were 32 bits long. The 7/32 sold so well that Interdata immediately began work on a true 32-bit computer, the 8/32 Megamini, first delivered in 1975.

- Meanwhile, Systems Engineering Laboratories (now Gould S.E.L.) had launched two 32-bit real-time minicomputers (models 85 and 86) that competed in the OEM systems market with the Interdata 7/32. In 1975, Gould S.E.L. marked its entry into the end-user supermini market with the S.E.L. 32/55. The 32/55 was an up-based, bus-centered system that the 86/85 instruction set implemented in microcode. In addition to its 32-bit orientation, 32/55 was distinguished by a 26.7M-byte-per-second effective bus data rate, while the Digital Equipment Corporation's PDP-11 Unibus data rate was about 6M bytes per second.

- Interdata and S.E.L. had the 32-bit supermini market to themselves for a number of years. Their nearest competitors were the 24-bit Datacraft Slash/4, /5, and /7 (which evolved into the Harris S110/0, S110/5, and S200, respectively) and high-performance 16-bit minicomputers such as DEC's PDP-11/45 and PDP-11/70, Data General Corporation's Eclipse, and Modular Computer Systems' Modcomp IV.

- Gould S.E.L. and Interdata both enhanced the total performance of their systems by implementing shared-memory configurations. The Interdata 8/30 Megamini allowed as many as 15 processors to share a memory block, while Gould S.E.L. as a rule linked four processors to a common memory. In general, all superminis use 32-bit architecture and sell in the range of $100,000 to $300,000. Most support a wide range of languages and batch and on-line operating systems.

- Today's superminis include Data General's Eclipse MV/6000 and MV/8000, the DEC VAX 11/750 and 11/780, the Gould SEC 32/27 and 32/87, the Harris 300,

500, and 8000, the Hewlett-Packard Series 3000-64, the Honeywell DPS-6/96, the Perkin Elmer 3250, and the Prime series of equipment (150, 250, 550, 750, and 850).

- IBM's 4331 and 4341 represent the major competition for this market. Other new competitors, including Convergent Technology, Fortune Systems, Spartacus Computer, and WICAT systems, are also entering the market.

- Part of the foundation for this rapid growth in the supermini market comes from the developing distributed market segment in which customers buy superminis as well as mainframes to achieve an integrated nationwide system. Low supermini prices have let users in branch offices with both local and centralized processing requirements justify dedicated local superminis that communicate with a large mainframe host.

- Such local systems usually perform interactive and transaction processing best served by table-driven asynchronous subsystems. When more than 10 or 12 workstations are involved, the local system must have low-end mainframe power. Mainframe vendors with interactive and transaction processing products and supermini vendors with interrupt-driven real-time products are both trying to adapt their systems and software to the new requirements.

- Mainframe vendors, especially IBM, claim greater expandability and the availability of more packaged software at indirect cost savings because mainframes require less programming time and expertise. Minicomputer vendors counter with claims of lower prices for equal performance and lower overhead in their simpler operating systems. The rapidly declining mainframe prices appear to make these price claims questionable. Furthermore, IBM has announced the SSX/VSE version of DOS/VSE and other simplified, user-friendly integrated operating packages.

- These tradeoffs are difficult to evaluate. Each manufacturer includes a different set of system features, different performance and capacity param-

eters, and unique architectural characteristics that make its system better for some applications than others. Exaggerated differences tend to obscure basic similarities, and even general comparisons are difficult.

6. STANDARD SMALL BUSINESS SYSTEMS DEVELOPMENTS

- Faced with significantly increasing price and product competition, some small business system vendors such as Qantel, Microdata, and Basic Four have begun to develop applications packages targeted toward well-defined vertical markets. This provides the capability to gain market share in market segment niches where there is less competition from the under-$15,000 systems that are sold on a hardware price/performance basis, or from the under-$10,000 microcomputers with very extensive catalogs of canned software.

- An associated marketing strategy is to provide more powerful upward-compatible small- to low-end modern business systems as a direct migration path for the existing customer base. In essence, the emerging successful strategy for the standard small business system vendor is to:

  - Develop industry-specific software designed for the vendor's specific hardware, thereby gaining new customers.

  - Expand the customer base as well as retain existing customers through upward hardware compatibility and expandability for existing software developed by clients.

- In both cases, the standard small-systems marketing and product concept is becoming increasingly software driven and/or constrained. Related to the concept of vertical market segmentation is the need for industry-specific distribution mechanisms. This has usually been achieved through trade associations and service-oriented distributors.

- Compounding the difficulty of selling to small businesses is the lower profit margins on these systems, compared with those on large, sophisticated computers. While a small-computer system typically costs a fraction of the price of a larger machine, the first-time computer customer often needs more service and support on a per-acquisition dollar basis than does the large corporate counterpart. Classic distribution channels (such as direct sales representatives or third-party systems houses that buy a "bare bones" small computer, add software, and resell the package) are too costly to support a $10,000 to $20,000 system. As a result, new distribution and service support channels and efficiencies must be developed.

- As prices of small computer systems keep falling, vendors are experimenting with a growing variety of marketing and distribution channels to find the best way to reach their intended market. The traditional approach of direct sales, or sales through OEMs or system houses, is not always possible when products carry a lower tag and when sales to end users consist of few units per transaction.

- Marketing methods in current vogue include company-owned computer stores and/or independent retail computer outlets, although direct sales still exist. Playing a growing role is the office products dealer who can provide access to an already-existing clientele that he previously has been servicing with office products.

- Reaching the retail outlets presents a problem of its own - the growing variety of distribution or wholesale channels. Several of the vendors are developing their own particular strategies.

a. Hewlett-Packard

- Hewlett-Packard Company is beginning to broaden its distribution channels for its low-end computers, including the new HP-85 personal computer, and as a first step has agreed to team up with Xerox to sell its high-end calculators in what the office products giant is billing as a "one-step supermarket" for small businesses.

b. DEC

- Digital Equipment sees no conflict between the different approaches to selling small business systems. If a large company is buying a number of small systems at one time, then DEC feels it would be worthwhile for a salesman to make a personal call. If, on the other hand, the customer is interested in only one system, then this customer would most likely buy from a retail outlet.

- To accommodate the latter, DEC has 25 company-owned stores, known as Digital's Computer stores. This number is down from 27 a year ago. A store in Detroit and one in the Wall Street area were closed, ostensibly due to the recession and poor location.

- DEC is also signing independent office product dealers. These dealers can be in the same geographic areas as DEC's own computer stores. Office product dealers tend to go after their own established customer base, that is, after customers who most likely would not be available to DEC. For this reason, these vendors could be located in the same town as DEC's own stores; they are not considered mutually inhibiting. Both the Digital computer stores and the independent dealers - known as DECdealers - carry the DECmate product line. DEC's own stores also carry the WS78, plus vertical application software packages.

- In addition, DEC also is signing industrial distributors who would sell small computers through their own dealers. In essence, DEC wants to have a variety of outlets to reach the market.

c. Data General

- Data General already has a network of more than 130 independent computer and office product dealers that has been handling the microNova, which retails for approximately $22,000. They also carry Data General's small

business system, the Enterprise 1000. Data General is planning for a network of as many as 400 dealers.

- At Data General the decision of when to sell directly and when to go through a retail operation depends on the price of the equipment. Generally speaking, at above $20,000 direct sales becomes a possibility. Below $5,000, a product definitely has to go through a dealer. Between these two figures, however, is a gray area in which overlapping marketing channels are possible, depending on the customer.

- Data General's policy is that if a customer is already an account, Data General will continue to serve him. If, on the other hand, the request for a low-priced system were to come from a new account, Data General would most likely turn it over to a dealer.

- Data General sees the dealers handling three segments of the market: personal computers, personal business computers, and small business computers. The distinction among the three often is difficult to establish, but all three lend themselves best to service through a local dealer.

d. Basic Four

- To cover the small-systems market, Basic Four uses its own sales force as well as its dealers'. Dealers are used in secondary market areas where it does not pay to maintain direct, company-owned sales people.

- Basic Four does not differentiate along price lines; it carries some systems and its dealers carry others. Basic Four merely uses dealers to get into areas where the company itself could not do so profitably.

e. IBM

- IBM markets its systems through two channels: IBM stores and regional computer centers/branch offices.

- The stores, located in Philadelphia, Baltimore, and San Francisco, carry small business computer systems, including the most recently introduced, Datamaster, which at a $9,830 entry-level price is IBM's lowest-priced small system. (The price can range up to slightly over $20,000.)

- With the introduction of steadily less expensive small systems, the question of how low a system can be priced and still be offered directly through the sales force becomes critical. IBM sees no definite limit in this respect. So far, it has been able to handle successively lower priced equipment, and it sees no reason why this cannot continue. The problem is not so much price, but generating a high enough level of business.

- While IBM is succeeding in improving the price/performance levels of its machines, it is also responding more aggressively to competition through development of market channels aimed directly at small-system users, a contrast to the company's lethargy during the early 1970s. IBM is much more competitive now in the small-systems market than it was five years ago, and will be even more competitive in the near future. The company, a pioneer in innovative distribution channels, established business computer centers in late 1977 to sell its small-business line to groups of executives. Centers are now operating in 50 U.S. cities and 30 cities abroad.

7. PERSONAL COMPUTER VENDORS

- While the major computer vendors outlined above are expanding downward into small business computers, the personal computer makers are aiming to move their products from the home into the office. Tandy Corporation, for example, plans to build up its base of nationwide computer stores and special

departments in its Radio Shack electronics centers. Similarly, Apple Computer Inc., which sells its machines in Computerland stores, Xerox retail outlets, and through office equipment dealers, is now setting up its own distribution network with regional sales and service centers.

- The general shares by distribution channel are shown in Exhibit III-5. As indicated, retail stores are still a small portion of the distribution, as measured by revenue; however, they are growing rapidly from their small base. The major channels of distribution are still the OEMs and system house/integrators.

EXHIBIT III-5

DISTRIBUTION CHANNELS FOR MINICOMPUTERS
AND SMALL BUSINESS SYSTEMS
(1982)

DISTRIBUTION CHANNEL	PERCENT OF SALES	PERCENT OF TOTAL FIRMS	REVENUE GROWTH TREND FOR 1981
Hardware/Product Manufacturers	24%	17%	Growing Slightly
Systems Houses/Systems Integrators	40	42	Down
Hardware Dealers/ Distributors	16	19	Growing Slightly
Software Houses/Software OEM	17	19	Stable/Flat
Retail Stores	3	3	Growing Rapidly
TOTAL	100%	100%	Growing

IV NEW DEVELOPMENTS IN SMALL-SYSTEMS SERVICE MANAGEMENT AND TECHNOLOGY

IV NEW DEVELOPMENTS IN SMALL-SYSTEMS SERVICE MANAGEMENT AND TECHNOLOGY

A. INTRODUCTION

- A major issue in the small-systems market is the question of service. Many minicomputer vendors have long provided good service, and it is possible to get on-site field service with 8- to 24-hour response. Most microprocessor vendors, on the other hand, request that the user carry the faulty system back to the computer store where it was bought. Micro vendors are only now beginning to recognize the importance of good, vendor-supplied service.

- However, from the user standpoint, service is as critical with micros as it is with minis. Users feel that the ease of doing board swaps is greatly improved and the ability to carry out really good diagnostics (down to chip level) is enhanced in the micro field. Due to the growing interest in on-site responsive service, some smaller vendors use a third-party organization to provide service.

- The larger small-system vendor organizations, particularly the mainframe-based vendors with existing large service forces and support infrastructures, have introduced remote diagnostic telephone service for small systems, which allows a home-office-based technical specialist to go on-line to the faulty machine and/or to the user, and do full diagnostics. Using this type of technical assistance, the problem can be resolved by patching around the difficulty

or by dispatching a service engineer who will already have a good idea of what the problem is and who will be able to carry the correct parts with him. In this way, phone-based diagnostics can greatly reduce the cost of service.

- While some mini vendors also provide remote diagnostics, the difference lies in the way a micro is assembled, which makes it much easier to make quick repairs. Boards are usually lower in cost; thus it is less expensive to increase sparing levels. In essence, it is simpler all around to replace a microsystem board or module, than to repair it in the field.

- In general, small-system users may not have much in-house computer expertise. Consequently, it is important to make small business systems easy to use and easy to repair. For its new System/23 Datamaster, for example, IBM maintains a special 800 number with 24 experts on call who are specialists in this particular type of computer. This telephone system often results in quicker service than calling in an IBM systems engineer, while at the same time it reduces IBM's charges for services.

- A major difference between small-system vendors and the personal computer/microprocessor OEM is service. The majority of the microcomputer system OEMs today simply don't have the service capability to support the user. Services are essentially on a phone-in or mail/carry-in basis.

- It would appear that it is only a matter of time until the micro vendors begin building good, reputable service organizations of their own, or enter into agreements with third-party service organizations to supply service to customers who want and need on-site support.

- However, it is strategically important to recognize that many micro system vendors consider their products to be disposable, "throw-away" items, even in the case of completely configured $20,000 systems. This is not the case with minis or supermini system vendors, chiefly because the initial investment is higher, and users demand ongoing services.

- In summary, servicing of small systems is becoming increasingly important as a key component or function of the small-systems market. Typically, most small-systems manufacturers, other than the major suppliers and the larger mainframe systems suppliers, left the area of service to third-party maintenance firms or established small service support groups as part of their marketing forces. However, the increasingly packaged nature of the small system requires new service capabilities, skills, and delivery mechanisms that must be managed on a cost-effective basis. In addition, the independent distributors of small systems do not appear to be providing business customers with the levels of service and responsiveness they require.

- Small systems vendors are searching for new, more effective methods for cost-effective service support and delivery. One approach is to use a van, equipped with parts, replacement modules, and skilled hardware/software specialists to service the small system customers; however, this approach is still relatively uneconomic in low-density areas. This and other concepts are outlined below.

B. NEW DEVELOPMENTS IN SERVICING OF SMALL SYSTEMS

- As indicated above, a number of new developments are taking place with respect to the servicing of small computer systems. These include:

  - Self-maintenance - In a number of larger companies using small systems (particularly in high-tech processes, and particularly in those in which the small systems are used in a critical on-line mode, such as by chemical companies and telephone operating companies) the use of self-maintenance is being developed.

- For example, a number of Bell Operating Companies have developed computerized systems for small systems self-maintenance control and diagnostics.

- Dupont has developed an in-house approach to the maintenance of small systems used in process control applications.

- Self-maintenance is still very limited, but may increase in the future if the quality and vendor responsiveness of small computer systems does not significantly improve.

  - Van Repair - Several system vendors are experimenting with the use of mobile vans that are equipped with service technician specialists, diagnostics equipment, repair parts, and some limited test and repair capability. The "man in the van" concept is of some value in providing full service for small systems in high-density urban areas on a timely and cost-effective basis.

  - Remote Diagnostics - The use of remote diagnostics, aided by portable terminals, is another concept now being developed. This involves establishment of a Technical Assistance Center (TAC) supported by small-systems specialists. The TAC is connected via telephone directly to the user or through a technician-owned portable terminal. TACs assist in diagnostic evaluation and fault isolation.

  - Improved Dispatch and Resource Allocation - A number of small-systems vendors, including Basic Four and Microdata, have automated the call-handling and dispatch operations of their service operations to improve responsiveness, reduce lost time in call handling, and make use of sophisticated algorithms to determine optimum dispatch.

- Many of these firms are also now using automated paging and/or "beeping" systems to maintain contact with field service technicians and are tracking the location of service technicians to optimize their allocation and meet customer requirements.

- Cellular radio will, in the near future (1984-1985), provide the capability for real-time control of service technicians in major metropolitan areas.

C. TYPICAL RELIABILITY AND SERVICE PROBLEMS OF SMALL SYSTEMS

- Based upon discussions with several small-systems vendors, it would appear that the most common cause of small-system failures is directly related to their use in an office environment. Typical small-system maintenance and service problems include:

  - Overheating - Most small systems operate in a normal room environment, rather than the controlled environment of the typical mainframe. Overheating, which decreases the circuit level MTBF, is thus a substantial problem.

  - Static Electricity - Static electricity generated by touching the machine, or by external electromagnetic pulses from local power lines, etc., can be a problem, particularly for small systems located in a standard office environment or near windows.

  - Dirt and Dust - These can be fatal to disk drives and diskettes. This is particularly a problem if the small system is utilized in a "dirty" environment such as a warehouse or manufacturing area.

  - Local Power Failure - This can be a problem, particularly for small, rapidly growing offices. A power loss will wipe out some of the memory of most small computers.

  - Voltage Fluctuations - Lower power sources normally used for small computers vary widely, especially in urban and industrial areas. These

types of fluctuations can cause particularly difficult types of intermittent problems. While a voltage regulator will protect a computer from this type of problem, it is generally expensive (i.e., $1,000 plus) when compared to the small-system price.

- Modem and Phone Line Problems - This is a particular problem for network-based small systems or small systems tied to a central host. This is a particularly difficult problem area to isolate because more than one service unit is usually involved.

- In order to offset these problems, several alternatives should be considered:

  - Preventive Maintenance - To identify and isolate problem areas and take action before the problem becomes serious.

  - User and Operator Training - Improved training both at and after installation can be extremely useful in helping system operators to recognize service problems and take appropriate self-corrective action.

  - Loaner/Replacement - Another approach is to use loaners or replacements in the event of a serious or recurring service problem.

- In general, small-system vendors need to develop more precise data bases that relate symptoms to causes and corrective actions by product configuration, in order to develop more effective methods for rapidly identifying service problems and initiating preventive maintenance or field fixes. Effective management and control of the field service reporting process can be extremely helpful in pinpointing high-failure-rate situations and reducing field failures.

D. NEW SERVICE PRODUCT DEVELOPMENTS

- In addition to the above technological developments, work is being done to improve and expand service product portfolios. These developments are outlined below.

1. TIME-OF-DAY AND DAY-OF-WEEK COVERAGE

- Several vendors have increased their flexibility. The customer is able to select time-of-day coverage, Monday through Friday; this provides maintenance service availability when the system will have its heaviest use and the greatest need for service. This service is priced at a premium when it is outside the standard 8 to 5 period.

- If the customer requires additional service outside the standard weekday period, it can be rendered in one of two ways selected by the customer. The first way is that the customer pays a fixed monthly rate over the prime shift period. The customer's second option is to pay for service performed outside the standard period at an hourly rate. The service options are designed to give the customer a wider range of choice in deciding how maintenance is to be performed.

2. GUARANTEED UPTIME

- Guaranteed uptime is another feature being offered by some vendors.

3. LEVELS OF SERVICE RESPONSE

- Some firms now offer users cost-saving or premium service for different levels of response. For example, most service organizations have had only one level of response time, four-hour same-day service, but now users can opt for next-day service and receive a 25% savings with respect to the same-day

service option. Alternatively, they can receive one- or two-hour service, at a premium of 25% to 50% over same-day, four-hour service.

4. REMOTE DIAGNOSTIC SERVICE

- Some firms are also providing users, on a direct basis, with up-to-date hardware and software maintenance techniques (remote diagnostics, etc.). Remote diagnostics were originally used as a phone dial-up service for consulting on hardware and software problems by field technicians. However, several companies have since expanded this use and offer the capability directly to users for remote diagnostics at their own sites (multiuser sites).

V TACTICAL CONCLUSIONS AND RECOMMENDATIONS

V TACTICAL CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL CONCLUSIONS

- The increasing capability and integration of small systems have made the problems of providing service more difficult. Small-system users are growing more dependent on their equipment and are looking for:

  - More cost-effective and responsive service and support.

  - A single source of maintenance for the array of products installed, especially if the small-system products are integrated into a larger network.

  - Improved ability to provide software-based services.

  - Improved related support services, including improved documentation.

- Associated with these needs is the customers' increasing requirements for improved and controlled hardware and software maintenance response, repair times, and performance. The servicing and support of small computer systems should be considered in the context of the overall role and mission of the service organization. In point of fact, small systems are sold and/or serviced by one of several different types of organizations:

- Large/medium mainframe-oriented manufacturers whose product lines include small systems.

- Small-systems and mini- and super- minicomputer manufacturers offering a broad array of products directed toward the end user.

- Third-party maintenance organizations operating in targeted markets relating to small systems.

- Special application system suppliers including, but not limited to, CAD/CAM, banking automation, process control, etc.

- Naked or stripped mini and small-systems vendors selling directly to OEMs and systems integrators.

- While each of these organizations has unique problems associated with the servicing and support of small systems, in general the first three classes are providing a broad array of services; small-system users represent only one of the markets.

- The most critical issue for all small-systems service organizations is that small-systems users are becoming increasingly dependent on small systems, and, except for the OEM systems integrators that are buying small systems for their own use, lack the capability for service. Thus, a primary tactical issue facing small-systems service organizations is the need to establish a cost-effective ability to deliver required, quality hardware and software service in light of continuously eroding product prices and the needs of unsophisticated users operating in a relatively uncontrolled environment.

- In essence, the small system has come of age and is now becoming as critical to the operation of the small user as the large mainframe was to the large user. However, there are two very critical differences between the small-system and the medium-/large-system marketplace. These are:

- The systems acquisition price is, on an absolute basis, much lower; therefore, the existing standard service price tactic of relating service price to a percentage of acquisition price generally requires that the service and support for small-system users be less extensive.

- The well-controlled operating and support environment (specifically, levels of air conditioning, dust-free environment, static-free environment, constant voltage, current regulation, etc.) is not present, causing a higher rate of failure than found in the medium-/large-systems environment.

- In essence, the critical tactical issue is that the service needs and requirements of small-systems users are, on a relative basis, greater than those of larger systems users, although on a cost or price-related basis, utilizing the historical service-pricing relationships, small-system users can only "afford" a lower level of service. In essence, the solutions to this dilemma could be achieved utilizing one or a combination of three different approaches:

I. CHANGES IN SERVICE PRICING STRATEGY AND TACTICS

- Numerous market studies carried out by INPUT clearly indicate that customers are willing to pay for additional service and support that they want and need.

- This is clearly indicated in INPUT's recent user survey, shown in Exhibit V-1, outlining users' willingness to pay premiums for "special" service. Thus, the historical precedent of charging for service as a percentage of purchase price is suspect and should be reevaluated. There is no reason to believe that customers will not pay for required services. In essence, revised service pricing tactics should be considered for small systems.

EXHIBIT V-1

USERS' WILLINGNESS TO PAY PREMIUMS FOR EXTENDED SERVICES

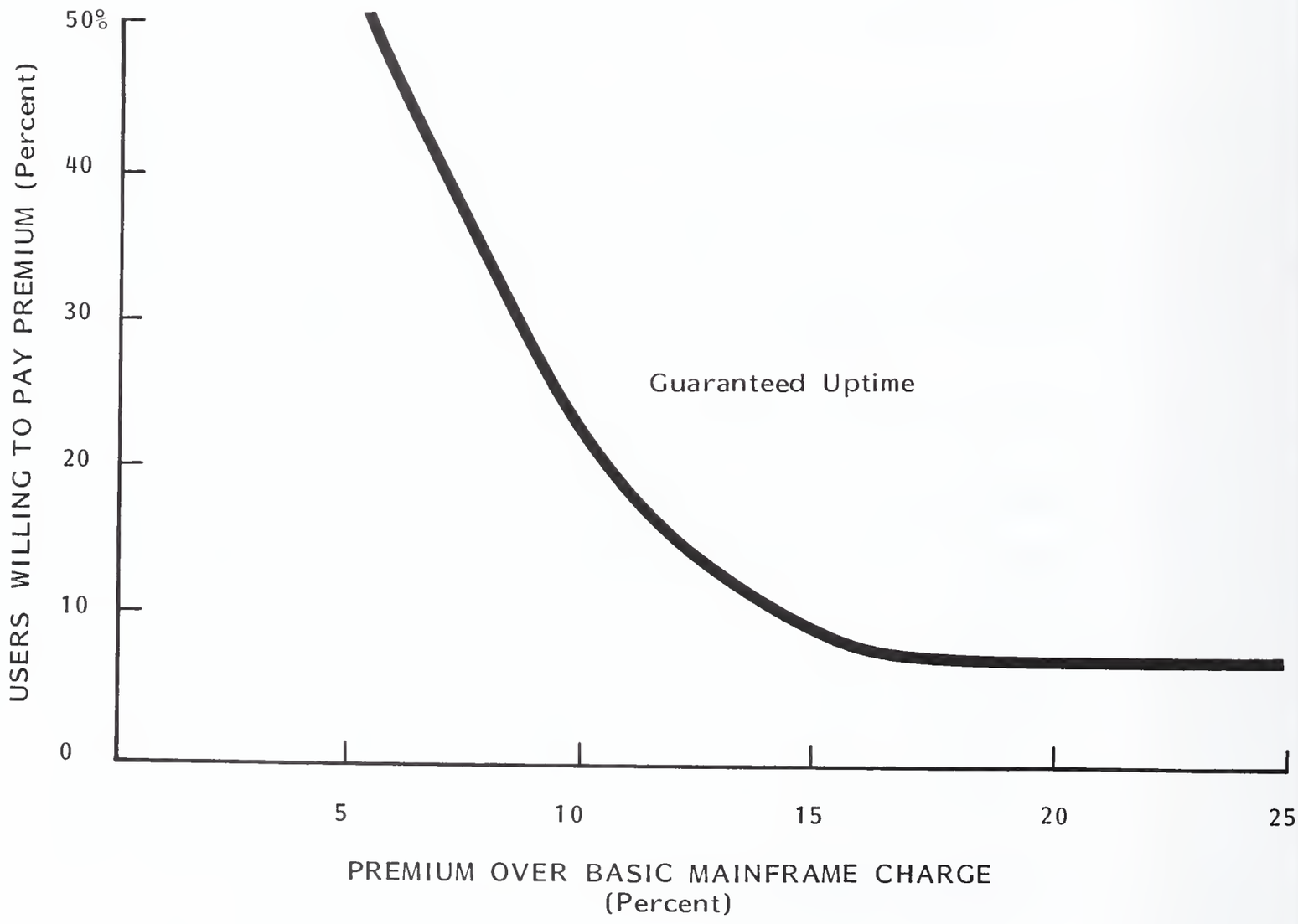


EXHIBIT V-1 (Cont.)

USERS' WILLINGNESS TO PAY PREMIUMS FOR EXTENDED SERVICES

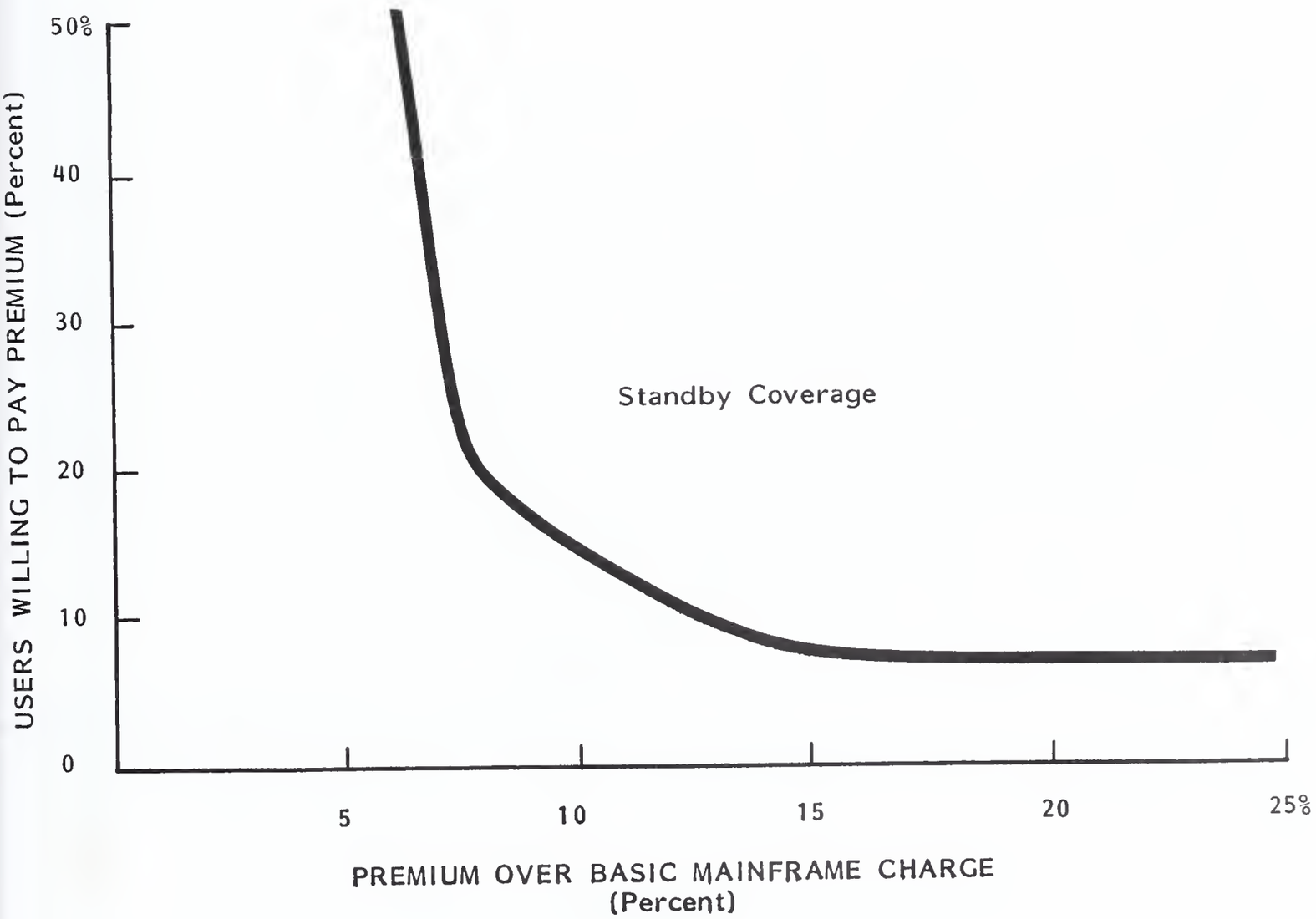


EXHIBIT V-1 (Cont.)

USERS' WILLINGNESS TO PAY PREMIUMS FOR EXTENDED SERVICES

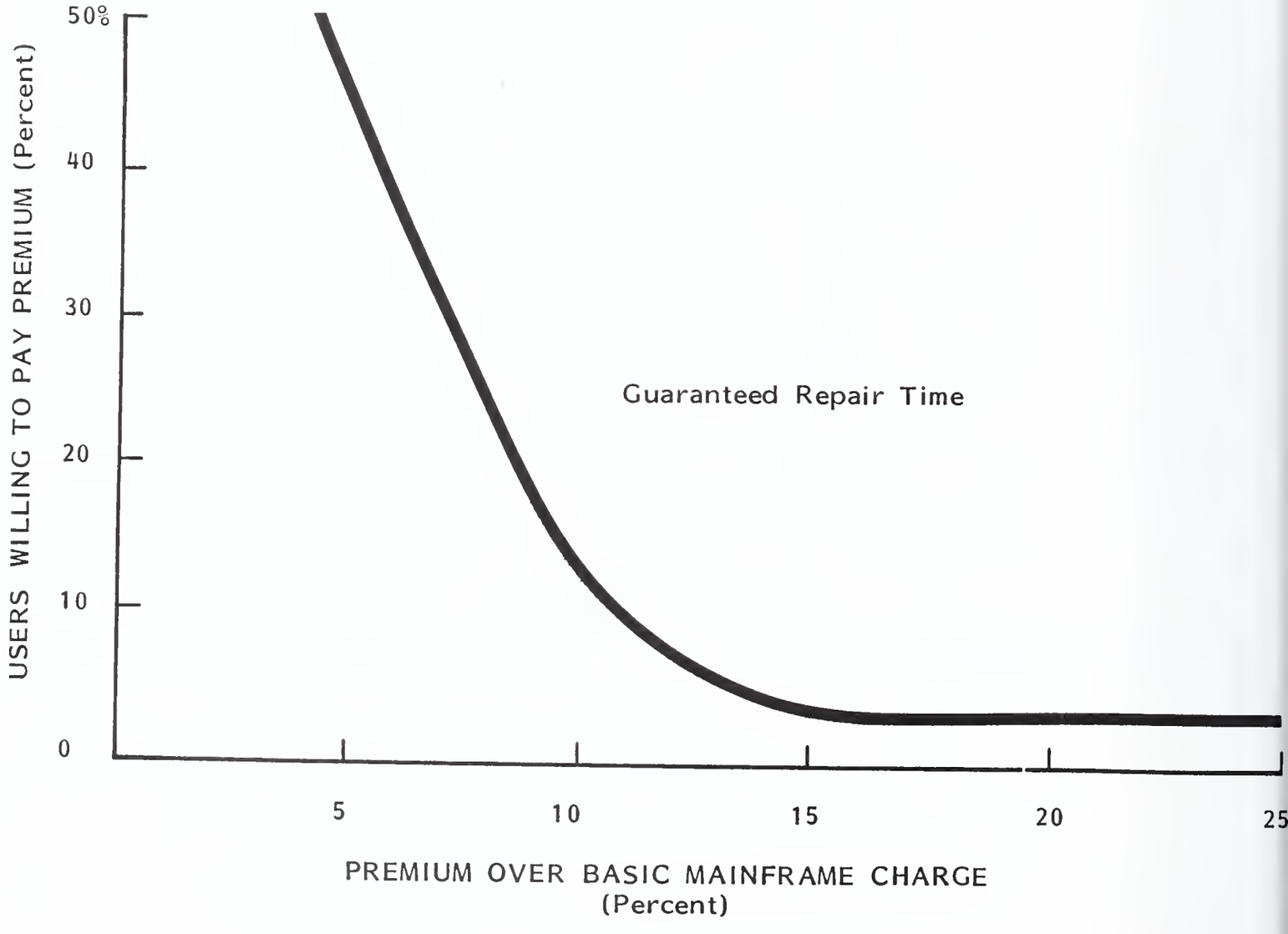


EXHIBIT V-1 (Cont.)

USERS' WILLINGNESS TO PAY PREMIUMS FOR EXTENDED SERVICES

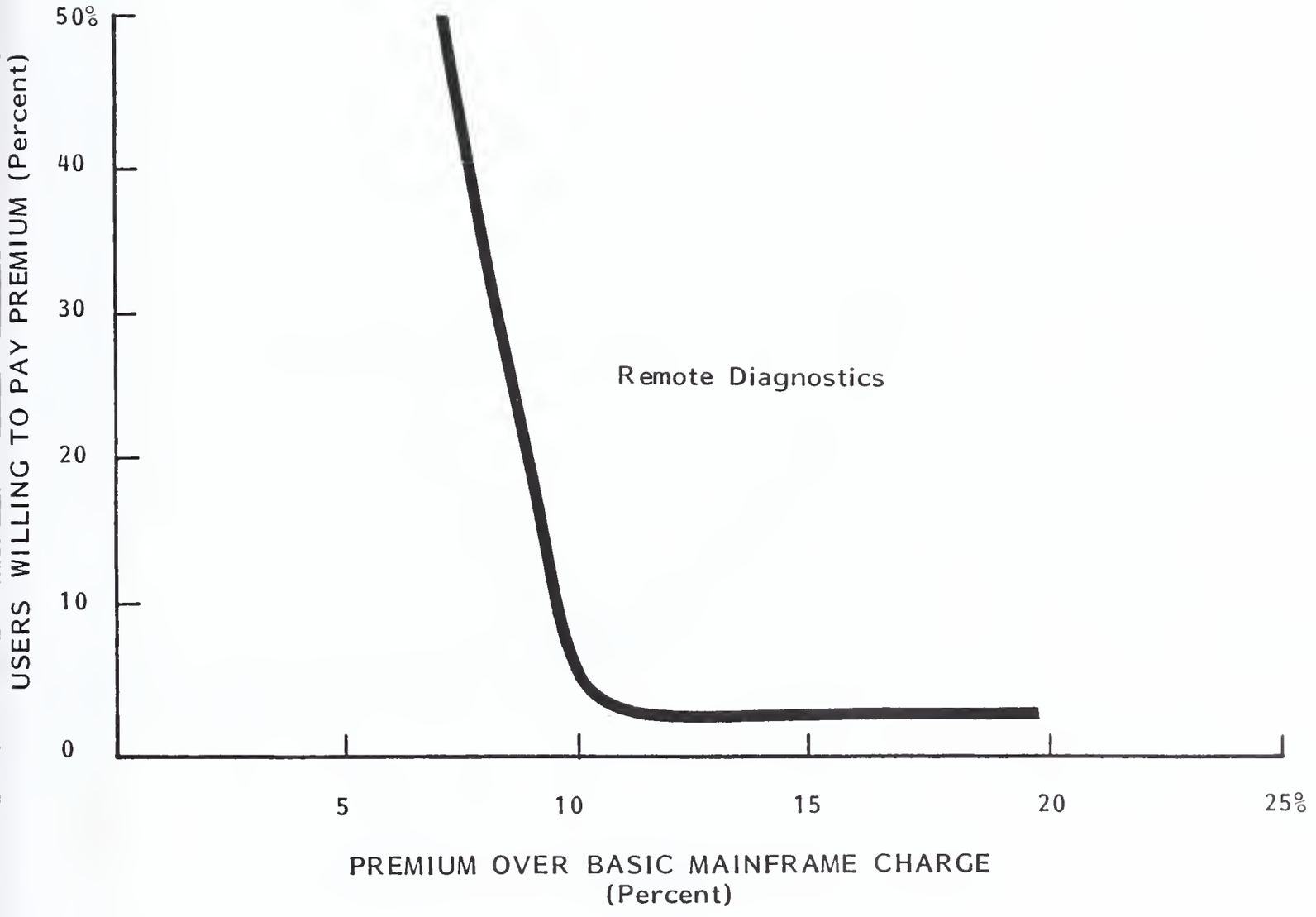


EXHIBIT V-1 (Cont.)

USERS' WILLINGNESS TO PAY PREMIUMS FOR EXTENDED SERVICES

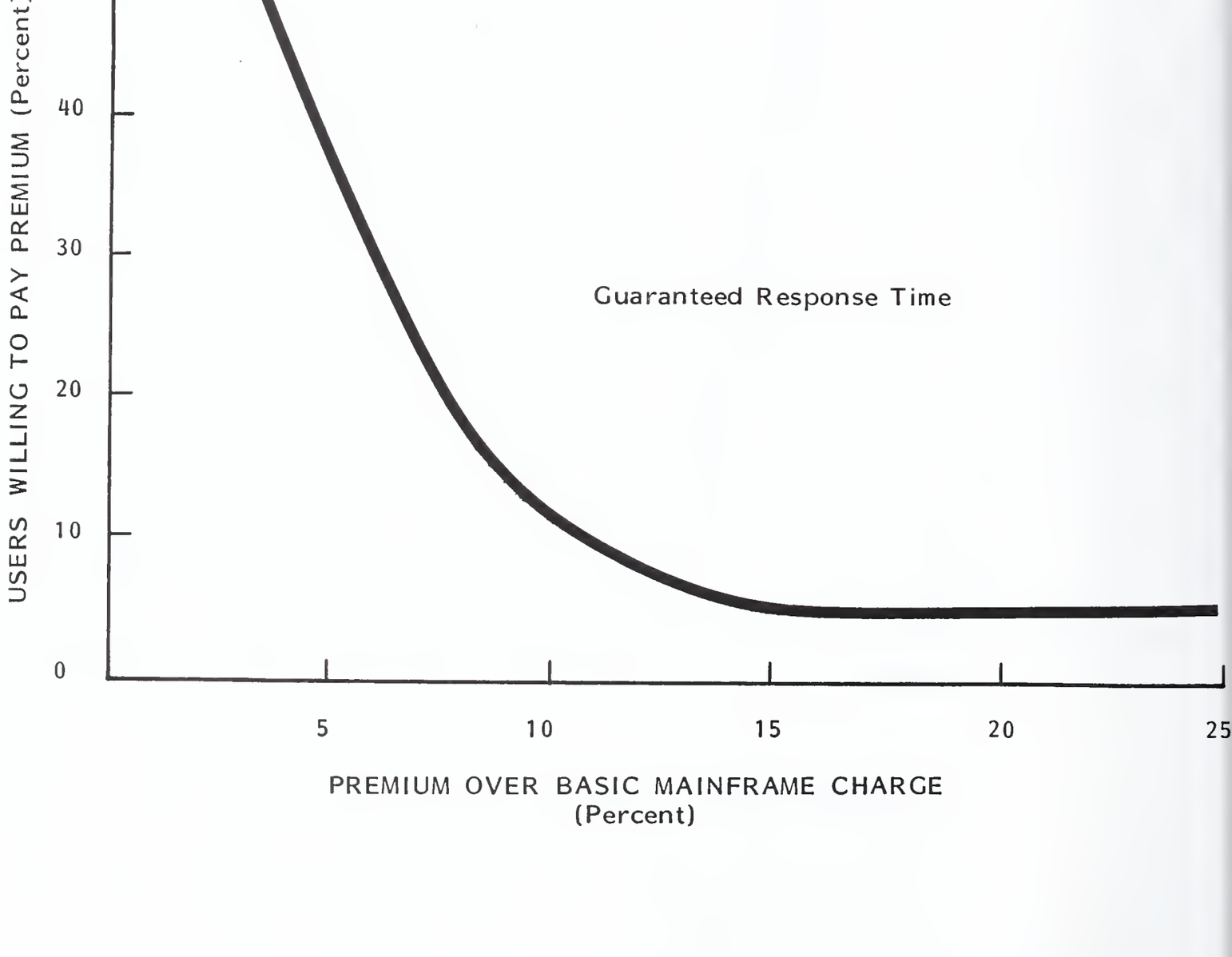
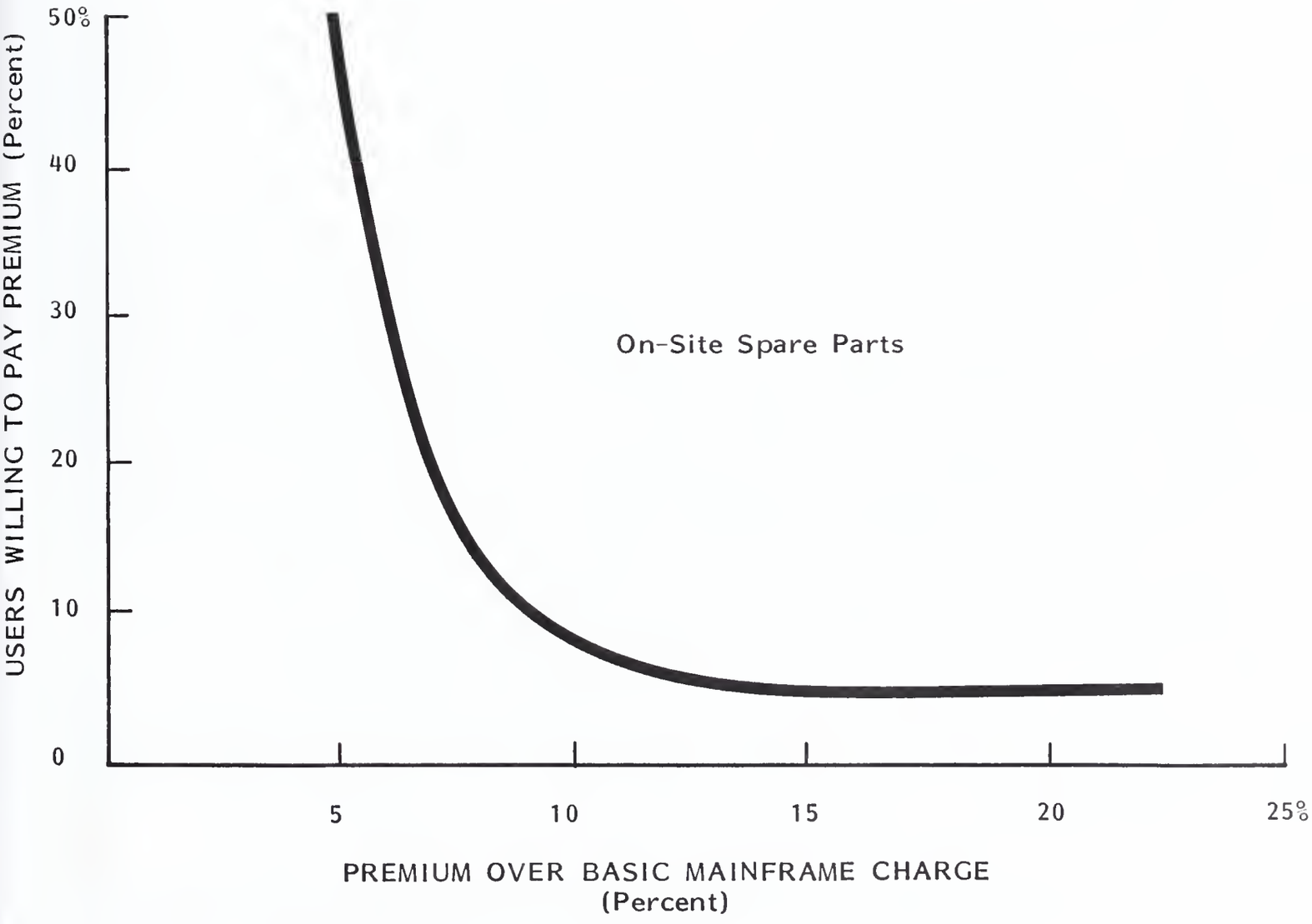


EXHIBIT V-1 (Cont.)

USERS' WILLINGNESS TO PAY PREMIUMS FOR EXTENDED SERVICES



2. CHANGE IN THE EFFICIENCY AND ALLOCATION OF SERVICES AND DELIVERY MECHANISMS

- A second major tactical direction that should be considered is the introduction of new techniques for delivery of service to small-systems customers in both high-density and low-density areas. In high-density areas this can be achieved through the use of the "man-in-a-van" concept (a mobile van is equipped with test equipment, spare parts, and loaners; it roams a given area providing on-call service).

- The use of the service van concept reduces the percentage of time that the service technician has to return because of a lack of parts; it also reduces the amount of on-site repair time through the ability to make a loaner or full replacement in the event of a serious outage problem.

- An alternative delivery approach is the use of multiple-task teams (of three to five service technicians) assigned to service accounts. A task team, assigned on the basis of work load, is responsible for maintaining a certain level of uptime for assigned accounts and can engage in both repair actions or preventive maintenance actions at their own discretion. In essence, the task team approach allows the field service engineer to utilize his own initiative to provide a given level of service to match individual customers' needs and requirements.

3. IMPROVED RESOURCE ALLOCATION AND CONTROL

- A third tactical approach involves significantly improving the level of control and allocation of service resources in order to meet differing customer response requirements.

- This involves the development of computerized systems for the management and control of service calls, including the use of diagnostics to screen out all service calls that can be handled by phone.

- This concept will also involve initially utilizing beeping or paging systems to locate service engineers in an on-line environment.

- In subsequent years and by the end of the decade, this will involve the use of cellular radio/telephone communications to provide on-line interactive communication and control of service engineers for all service calls assigned in a given geographic area.

- In summary, one or a combination of the above strategies (i.e., price changes, changes in service delivery mechanisms, and/or improved service personnel resource allocation and control) must be used in order to meet small-systems customers' changing needs and requirements for service and support.

- It appears to be clear that a growing number of small-systems users are dissatisfied with the levels of field service support (hardware and software) provided after sale and installation, and with the levels of documentation. As indicated in Exhibit V-2, there is, except for IBM, a high (40% or more) percentage of user dissatisfaction with some aspect of almost all vendors' maintenance service.

- In general, the analysis and evaluation of key technological and product trends and research into user needs and key problems for small systems suggest that there is significant user concern about service and support. There is also increasing user focus on the quality of response for hardware and (particularly) software maintenance and support.

- This increasing level of dissatisfaction with the hardware and software maintenance and repair service offered by small-systems vendors in general and Autotrol, Intergraph, NCR, Prime, Hewlett-Packard, and Data Point in particular is shown in Exhibit V-3. This view of users is supported by trends shown in other related topics, including:

EXHIBIT V-2

DISSATISFACTION WITH KEY SERVICES OFFERED BY VENDORS*

(Percent Expressing Dissatisfaction with Level of Services Offered, Compared to Requirements)

	SERVICES	AUTOTROL	BURROUGHS	COMPUTERVISION	DATA GENERAL	DATA POINT	DEC	FOUR PHASE	HEWLETT-PACKARD	HONEYWELL	IBM	INTERGRAPH	NCR	PRIME	TEXAS INSTRUMENTS	OVERALL
		VENDOR														
INSTALLATION	Environmental Planning	19.0	30.0	10.5	20.0	5.0	22.6	20.0	15.0	13.3	7.5	30.0	14.3	15.0	5.0	18.1
	Physical Site Planning	19.0	20.0	5.2	13.3	5.0	29.0	20.0	20.0	13.3	2.5	10.0	19.1	10.0	15.0	16.4
	Consulting	23.8	23.3	21.0	16.7	20.0	25.8	20.0	20.0	23.3	7.5	15.0	19.1	15.0	10.0	21.6
	Documentation	52.4	53.3	68.4	43.3	35.0	38.7	35.0	40.0	50.0	20.0	60.0	33.3	30.0	50.0	45.3
	Training	42.9	20.0	31.6	26.7	45.0	22.6	35.0	25.0	30.0	25.0	40.0	33.3	15.0	35.0	31.3
	Installation Planning	28.5	26.7	10.5	26.6	30.0	16.1	25.0	30.0	20.0	15.0	30.0	9.5	15.0	15.0	20.8
FIELD SERVICE	Hardware Maintenance	71.4	46.6	42.1	46.7	45.0	35.4	40.0	45.0	30.0	32.0	45.0	57.1	55.0	30.0	34.5
	Software Maintenance	61.9	30.0	57.9	33.3	45.0	45.2	50.0	45.0	43.4	25.0	65.0	42.9	40.0	20.0	43.3
	Supplies Sales	14.3	26.7	57.9	66.6	40.0	41.9	55.0	20.0	46.7	37.5	20.0	23.8	60.0	65.0	36.8
	Add-On Sales	33.3	16.7	36.8	23.3	30.0	29.1	20.0	15.0	33.3	15.0	15.0	33.3	40.0	30.0	26.6
REMOVAL	Site Audits	23.8	13.3	10.5	13.3	.0	25.8	20.0	25.0	33.3	22.5	20.0	9.5	20.0	90.0	19.9
	Relocation	47.6	3.3	26.3	23.3	10.0	19.4	20.0	25.0	13.3	20.0	45.0	14.3	15.0	20.0	20.1
	Deinstallation	52.4	6.7	57.9	16.6	20.0	19.4	15.0	20.0	20.0	12.5	50.0	19.1	35.0	10.0	21.7

* Based on 1983 INPUT Survey of Users

= 40% or More Users Dissatisfied

SMALL-SYSTEMS OVERALL EVALUATION OF SERVICE POSTURE

(Satisfied, Overkill, or Dissatisfied/Problem Area – Based on Percent Respondents from Survey)

	SERVICES	VENDOR: AUTOTROL	BURROUGHS	COMPUTERVISION	DATA GENERAL	DATA POINT	DEC	FOUR PHASE	HEWLETT-PACKARD	HONEYWELL	IBM	INTERGRAPH	NCR	PRIME	TEXAS INSTRUMENTS	OVERALL
INSTALLATION	Environmental Planning	–	–	–	–	–	–	–	–	–	–	•	–	–	–
	Physical Site Planning	–	–	–	–	–	•	–	•	•	–	–	–	–	–	–
	Consulting	–	•	•	–	–	•	•	•	•	–	•	•	–	–	•
	Documentation	P	P	P	P	•	•	•	P	P	•	P	•	•	P	P
	Training	P	•	•	•	P	–	•	–	•	•	•	•	–	•	•
	Installation Planning	•	–	–	–	–	–	–	•	–	•	–	•	–	–	•
FIELD SERVICE	Hardware Maintenance	P	P	•	P	P	•	•	P	–	•	P	P	P	•	•
	Software Maintenance	P	•	P	–	P	P	P	P	P	•	P	P	P	•	P
	Supplies Sales	–	•	P	P	•	P	P	•	P	•	–	•	P	P	•
	Add-On Sales	•	–	•	–	•	•	•	•	•	•	–	•	P	•	•
REMOVAL	Site Audits	•	–	•	–	–	–	–	•	–	–	•	–	–	P	–
	Relocation	P	–	•	–	–	–	–	•	–	•	P	–	•	–	–
	Deinstallation	P	•	P	–	–	–	–	•	•	•	P	–	•	–	•
	Overall Rating	6.19	6.77	7.32	8.03	7.65	8.03	7.40	7.70	7.40	8.25	7.15	7.57	8.05	7.35	7.54

• = High Satisfaction – = Overkill P = Problem – High Dissatisfaction

Rating: 1 = Low, 10 = High

= Overall Rating Below 7.0

- Growing interest in third-party maintenance as an alternative to vendor service offerings by original equipment manufacturers.

- Increasing interest in more reliable systems, particularly for on-line interactive applications.

- Increasing willingness to pay a premium for guaranteed response time, repair time, and uptimes (see Exhibit V-1).

- Increasing interest in documentation as a base for self-maintenance and support.

B. MAJOR TACTICAL PROBLEMS

- The evaluation of the data available on hardware and software response time, as shown in Exhibit V-4, suggests that while small-systems-based service organizations are apparently responding within the timeframe required of most users, their hardware maintenance problem is primarily in the inability to correct the problem once on-site. This is related, in part, to the fact that most service organizations primarily track and control response time (elapsed time from call received to arrival on-site) rather than overall response and repair time (i.e., including repair).

- This lack of control over the overall response/repair time parameter (with a primary focus on response time only) can provide the service manager with a considerably different picture from that of the user, who is much more concerned about the total elapsed downtime than he is with initial response on-site. This is particularly true for some of the small-systems organizations such as Autotrol, Burroughs, and Texas Instruments, whose customers report significantly higher service response times than required.

EXHIBIT V-4

SMALL-SYSTEM HARDWARE AND SOFTWARE RESPONSE TIME*

(Required versus Actual Mean Time, in Hours)

	HARDWARE RESPONSE TIME		SOFTWARE RESPONSE TIME					
			SOFTWARE INOPERATIVE		SIGNIFICANTLY DEGRADED		MILDLY DEGRADED	
	REQUIRED	ACTUAL	REQUIRED	ACTUAL	REQUIRED	ACTUAL	REQUIRED	ACTUAL
All Vendors	4.45	4.82	3.43	6.32	5.04	8.37	27.49	28.82
Autotrol	11.48	14.29	5.11	5.11	12.60	12.60	47.47	52.70
Burroughs	4.76	6.17	5.08	14.42	5.54	15.42	33.20	31.40
Computervision	4.37	3.47	3.62	10.85	6.38	12.19	26.21	38.21
DEC	3.10	2.54	2.67	4.22	2.78	4.22	23.80	N/A
Data General	3.53	3.21	1.04	1.04	2.14	3.44	3.74	3.74
Data Point	2.25	2.50	1.43	1.63	2.56	7.22	29.05	28.60
Four Phase	2.87	1.84	2.98	3.16	3.16	3.35	14.95	22.87
Hewlett- Packard	3.60	2.92	1.98	3.35	5.75	14.25	9.24	17.00
Honeywell	2.63	2.96	2.24	1.00	2.58	1.59	17.81	4.56
IBM	3.89	3.51	2.76	5.85	4.54	6.51	10.21	9.91
Intergraph	7.85	8.65	3.65	3.86	4.31	4.00	34.62	34.62
NCR	2.28	2.88	2.29	6.46	3.38	7.31	13.00	23.57
Prime	3.03	2.34	1.38	0.63	5.17	3.94	33.33	16.00
Texas Instruments	9.68	13.68	11.25	24.37	11.25	24.37	170.40	155.80

= Insufficient response

- In this context, it is important to note that many of the small-systems service organizations have failed to coordinate all appropriate resources necessary to satisfy and support service in the field (including spare parts supply, technical assistance, diagnostics, software support, etc.) under a single management organization. Thus, it is possible that a service engineer arrives on-site within the required time, but by not having the right parts or the right technical information or data, he may have to return at a subsequent time in order to effect the repair.

- In organizations that separate material/logistics supply, software support, and/or technical diagnostics and assistance from the field service operation, this delay is thus not considered to be related to the field service organization. Yet, from the standpoint of the customer, obviously the overall elapsed time between the call for service and the completion of the fix is the critical factor.

- The problem with total management and control of service with respect to software maintenance for small systems is very severe. Most small-system service organizations do not meet customer requirements with respect to software service support in the case of full software failure, partial software failure, or minor degraded software failure operations (see Exhibit V-4).

- In summary, the major short-term tactical problem facing the management of most small-systems service organizations is the need to develop more effective methods for management and control of the overall elapsed time for service with respect to both hardware and software failures, and to ensure both fully managed and controlled delivery of all required resources (technical manpower on-site, parts, material, and technical diagnostics) and a timely, responsive, and efficient manner.

- Other areas requiring the attention of particular vendors include:

  - Need for improved documentation in both user and systems operations.

- Need for improved training, including computer-aided instruction, materials, and training aids.

C. RECOMMENDED TACTICAL ACTIONS TO RESPOND TO SERVICE CHALLENGES

- The recommended actions required in order to respond to the needs of small-system users include:

1. ESTABLISH FORMAL SERVICE RESPONSE AND REPAIR TARGETS FOR HARDWARE AND SOFTWARE

- It is critical that the service organization establish, at least internally, specific response and repair targets, which form the objectives and goals of the service force. These targets should be set and managed by market segment and product line. Actual performance should be tracked against targets to identify both overages (i.e., where the elapsed time exceeds that desired) and overkills (i.e., where the elapsed time is significantly less than that targeted).

- While most service organizations have established service targets and objectives for hardware response in general, there are few targets for overall elapsed time, including repair for hardware maintenance. There are also few specific targets and objectives for software maintenance and repair. The development of these targets and their implementation as part of a managed, controlled system is critical to improving small-system service efficiency.

2. IMPLEMENT A FULLY INTEGRATED SERVICE MANAGEMENT CALL-HANDLING DISPATCH AND CONTROL SYSTEM

- Only a limited number of small-systems service organizations have introduced some type of computerized assistance to support initial call handling on a regional or national basis. In fact, some small-system service organizations continue to coordinate and control service calls on a local-branch or district basis and fail to make use of economies of scale or more sophisticated methods for remote technical assistance and diagnostic screening of service calls.

- An integrated call-handling and dispatch system should be implemented that is interconnected to technical assistance for remote diagnostic screening, including capabilities for software as well as hardware maintenance.

- In essence, it is essential to introduce a coordinated system that will manage and handle calls from reception to completion, including the screening and initial diagnostic review of all calls, thus converting the call-handling process from a simple handoff (i.e., message handling) to a managed approach for the control and coordination of the service call from its point of initiation (time it comes from a call-in) to its completion.

- The service call requiring both hardware and software assistance would be managed through the regional or national service management system to ensure that full resources are allocated and directed toward specific customer problems. Use of the TAC/Remote Diagnostic Center as part of every call would ensure a cost-effective response to both hardware and software problems. In addition, if a part or material is required in order to successfully complete the assigned call, the parts resupply issue would also be managed and supported by the central service management system.

- In essence, most of today's systems for call handling and dispatch in small-system service organizations are oriented primarily toward initial receipt of

the call and handover of the service call to a hardware service engineer for action. These systems fail to provide overall management of the call, including a managed approach to the coordination of both hardware and software maintenance and repair, and to track calls in order to ensure controlled escalation of management actions in support of software and materials/logistics needs in the event that an open service call's elapsed time exceeds certain established threshold or service targets.

- It is specifically recommended that this more-managed systems approach be introduced at the regional and national level to ensure that the full resources of the service organization are appropriately directed and managed with respect to the arrival of individual service calls.

3. INTRODUCTION OF PRODUCT MANAGEMENT FUNCTION

- This third tactical action points to the creation of a product management function within the field service organization, involving the establishment of a product management group within the staff of the planning organization, or as part of the technical assistance and support group of the field service organization.

- This product management group's responsibility would be primarily to collect, analyze, evaluate, and manage the failure rate and repair time data associated with individual products and to provide a technical interface with marketing, engineering, and manufacturing with respect to the design/reliability tradeoff in the introduction of new products, engineering redesign, and phase-out of existing products.

- In essence, the service product manager would be concerned about the management of total service support for the life cycle of the product. For the products under his direction, the product manager would provide continuing monitoring, analysis, and evaluation of product failure rates, repair times, and service and support characteristics. The service product manager would

also act as a responsible interface for new product introduction, particularly relating to the determination of the tradeoff in the level of reliability and maintainability built into the product versus the cost of after-sales support.

4. OTHER TACTICAL/STRATEGIC INITIATIVES

- Other initiatives should be developed in response to the above trends and requirements. These are outlined below but discussed in more detail in the strategic analysis and evaluation.

a. Third-Party Maintenance

- Using its existing installed base, the field service organization should seriously consider possible entry into the third-party maintenance market. As indicated above, a significant trend exists with respect to the utilization of small systems in support of large, network-based distributed data processing systems and equipment. Under such a scenario, mini and microprocessor systems, personal computers, intelligent terminals, and other peripheral equipment will have to interface with large systems acting as host, network coordinator, and data base manager.

- It will become increasingly important for the service organization supporting small systems to be able to provide service to the other elements of the network to avoid finger pointing and to allow the user to deal with a single service organization. The inability of the field service organization to provide full third-party maintenance on other elements of the network could lead to a competitive disadvantage against full third-party maintenance organizations attempting to provide total service management capability. Thus, the entry into the third-party maintenance market represents a defensive move tactically and a strategic move from an opportunity standpoint.

b. Development of the Service Management Concept

- Related to third-party maintenance, but an independent tactical and strategic thrust, is the development of new, integrated service products dealing with the management of the total service required in an office.

- Management of the full array of service required in the total office environment, including office automation, telecommunications, and data processing equipment, will become increasingly offered by service organizations as part of a new, innovative approach to creating a totally integrated service portfolio. Here again the service organization supporting small systems should view the creation of a service management product as both a tactical, defensive move to avoid losing business and a strategic, offensive move to gain business.

- Third-party maintenance and service management will be discussed as part of the strategic recommendations.

D. RECOMMENDED ACTION PLANS

- In summary, the tactical recommendations based upon the key technical, marketing, and user requirements and trends discussed above include:

1. DEVELOPMENT OF A STRATEGIC APPROACH TO SERVICE PRICING FOR THE SERVICE PRICING PORTFOLIO

- While customers are increasingly focusing on the cost of service and the full cost of ownership, it is clear that customers are willing to pay more for the services they need. Little attention has been given in the past to service pricing.

- In most of the product markets, service has been priced based on a percentage of acquisition price. As a result, the small-system user has been given a lower level of service, reflecting his lower absolute purchase price. The development of a full service portfolio and different levels of service for different markets and products (i.e., fault-tolerant systems, remote diagnostics systems, etc.) requires a new approach to service pricing. In essence, the development of prices for the service portfolio must be based on a full evaluation of:

  - Cost of providing service.

  - Competitive prices.

  - Value in use.

- Most service organizations have failed to control or measure service performance against specified hardware and software response targets and costs, and very few have attempted to measure customer value-in-use for service. Thus, service prices have historically been driven by the percentage-of-acquisition-price standard. However, market studies show that the user does have specific, differing value-in-use for different classes of service, depending upon the market segment and product. This data should be used in developing efficient service pricing strategies and tactics.

2. DEVELOPMENT OF A SERVICE MANAGEMENT CONCEPT OF SERVICE OPERATIONS

- All classes of users have expressed an interest in the overall management of service for their installed base of office automation and data processing products. The development of this concept requires a total, full-service management of the service call and the concurrent development of support systems for call handling and dispatch, technical assistance, and materials/logistics inventory and pipelines.

- As indicated in the user preference survey, shown in Exhibit V-5, users primarily want on-site service, and while they are willing to support and work with remote diagnostics, they prefer that the service organization provide integrated response where and when needed. Users are much less interested in delivering a module to a service center or paying for on-site standby support that has not been requested.

3. DEVELOPMENT OF AN APPROACH TO THIRD-PARTY MAINTENANCE

- The rapid increase in third-party maintenance as a viable alternative requires that service organizations either enter the third-party service market independently or as a part of a service management concept, or develop a competitive posture based on improved service quality, responsiveness, and/or price reductions.

- In summary, service management must take a number of steps to meet the immediate challenges identified above. These include the establishment of full-service management capabilities, the implementation of service management systems, and the extension of service to product and market areas willing to pay for service. A summary list of recommended tactical actions is presented in Exhibit V-6.

EXHIBIT V-5

AVERAGE USERS' RATINGS OF ALTERNATIVE SERVICE DELIVERY MECHANISMS

PROBLEM AREA	SERVICE DELIVERY MECHANISMS					
	ON-SITE RESPONSE TO CALLS	USER INVOLVEMENT WITH SUPPORT CENTERS	REMOTE DIAGNOSTICS	REPLACEMENT OF COMPONENTS OR PATCHES	USER DELIVERS MODULE TO REPAIR CENTER	ON-SITE STANDBY
Hardware	8.4	5.5	6.3	5.1	4.0	4.0
Software	8.1	5.6	6.6	5.3	3.9	4.0

Rating: 1 = Lowest, 10 = Highest

EXHIBIT V-6

RECOMMENDED TACTICAL ISSUES AND CONCLUSIONS FOR SMALL-SYSTEMS SERVICE

KEY TRENDS AND FACTORS	IMMEDIATE CHALLENGES TO FIELD SERVICE ORGANIZATIONS	SHORT TERM ACTION PLANS 1984-1985
Growing integration of office automation products	Service full product array without finger pointing	1. Establish service management capability and function 2. Expand technical skills and parts availability at field level
Increasing complexity and sophistication of equipment	Improve ability to identify hardware and software problems and provide rapid response	1. Implement remote diagnostics/technical assistance center hot line 2. Improve support and user documentation
Increasingly tighter response and repair time requirements due to growing dependence on equipment by user	Manage and control service response and repair by targets in accordance with contractual guarantees and agreements. Avoid "over" or "under" servicing	1. Implement computerized systems to manage and control: • Call handling and dispatch and • Logistics/supply Based on management-set targets and objectives
Wide range of choices due to increasing numbers of vendors and products	Provide consulting and technical assistance as part of initial sales/service decision -- place increasing emphasis on service quality and responsiveness	1. Establish technical consulting assistance and installation support planning services 2. Provide service on a formal basis for a price
Increasing concern over service cost containment	Develop innovative pricing for product portfolio - targeted by market segment	1. Establish full product/price portfolio 2. Evaluate current service prices
Increasing use of local-area networks (LANs) to integrate individual office automation products	Provide ability to service and support LAN technology as part of product services	1. Expand technical capabilities to support LAN technology 2. Offer LAN service and support
Increasing dissatisfaction with services offered by OEM vendors and retail distribution channels	Expand national service, and back up retail/mass merchandise channels to provide integrated service support when required	1. Offer national call handling and technical assistance support to back up local retailers 2. Provide full service at a price for those segments requiring service on-site

VI STRATEGIC CONCLUSIONS AND RECOMMENDATIONS

VI STRATEGIC CONCLUSIONS AND RECOMMENDATIONS

A. GENERAL CONCLUSIONS

- Significant changes are taking place in the small-systems service market as a result of product and technological developments, increased price and product competition from large mainframe networks and PCs, and the growing use of, and dependence on, small systems as part of day-to-day activities. Users are interested in improved, responsive, and total service to meet their needs. The key long-term trends that will affect service in the long run include:

  - The full integration of small-systems products as part of a full network system.

  - The rapid obsolescence of the existing installed base.

  - The growing dependence of the user on the system, placing greater focus on responsive service.

  - The increasing complexity and sophistication of the individual types of equipment as a result of embedding more application-oriented software.

- These trends will create challenges and opportunities for services management, particularly field services that are organized as a separate profit center line of business.

B. NEW LONG-RANGE SERVICE OPPORTUNITIES

- Major opportunities created by these trends and changes are summarized in Exhibit VI-1. There are significant long-term opportunities being created in terms of the servicing of obsolete equipment, the ability to provide total service management, and the extension of service products.

C. RECOMMENDATIONS FOR LONG-TERM ACTION

- The major trends and factors that lead to both challenges and opportunities are also summarized in Exhibit VI-1. Recommended long-term action programs to meet these challenges and opportunities are also shown.

- In developing a long-term strategy to meet field service needs in small systems, it is important to recognize that several major changes are taking place that will affect both the customer service/field service organizations of small-systems vendors and third-party maintenance organizations focusing on the small-system marketplace. These factors relate to:

  - A significant trend toward integration of individual systems through local-area networking. To a large extent, we will see emerging two classes of small-system users: those operating as part of large, integrated networks and those using only small, individual standalone units.

  - The growing importance (for improved service response and repair) of ensuring that small systems are available when and where required. This places greater emphasis on the need for service management and for the provision of a totally integrated service support effort after the initial sale.

FIGURE VI-1

STRATEGIC ISSUES AND CONCLUSIONS

MAJOR TRENDS AND FACTORS	LONG-RANGE CHALLENGES TO FIELD SERVICE MANAGEMENT	STRATEGIC OPPORTUNITIES	RECOMMENDATIONS FOR LONG-TERM ACTION PROGRAM, 1985-1988
Integrated office systems combining data processing, word processing, and telecommunications functions. Growing importance of service issues in purchase decision as products become increasingly commodity-like and life cycles shorten. Need for integrated, single source of service; especially in connection with fully integrated network-based office automation systems.	• Establish service as a separate line of business in support of general office automation technology. • Develop a full-service organization to produce a full array of "products" for the office environment, including: – Installation and site planning – Installation – Hardware maintenance – Software maintenance – Moves and changes – Upgrades/configuration changes – Documentation – Training – Parts/supplies – Consulting – Other support service	• Service as a separate revenue and profit-generating line of business. • Service management as a framework/ concept for managing and delivering support.	• Establish full profit center service operation with supporting marketing, product and business planning, and financial/accounting functions. • Define full-service product portfolio. • Expand into third-party maintenance for those products under the service management umbrella.
Need for a comprehensive portfolio of services to support all aspects of after-sales support, including training. Need for establishment of a strategic pricing approach by market segment.	• Implement a comprehensive system to manage and control service as a business, including: – Installation planning and scheduling – Call handling and dispatch – Preventive maintenance scheduling – Technical assistance/remote diagnostics – Order processing and inventory control – Data base management – Reporting – Invoicing & cost accounting • Provide service portfolio customized to meet needs of individual market segments and niches. • Base pricing on evaluated combination of cost, competition, and value-in-use.	• Management and control of service delivery, responsiveness, and quality to meet customer needs at a profit. • Increase profit margins and return on investment from service-based activities.	• Collect and allocate data on costs and revenues from individual products as a basis for service pricing. • Implement remote diagnostics and technical assistance centers accessible via a national 800 number. • Measure customer needs, requirements, and performance on a continuing basis. • Develop accurate data on MTBF and MTTR as a basis for new product planning. • Implement integrated system for service management control with common data base.

- Increasing customer interest in cost containment and the provision of reliable, guaranteed responsive, quality service.

- These trends all point the way toward a need for a comprehensive, integrated strategy that provides for the management of the service function from point of sale to full after-sale support, including all the associated products, such as:

  - Site and installation planning.
  - Installation.
  - Hardware maintenance.
  - Software maintenance.
  - Documentation.
  - Training.
  - Supply and parts sales.
  - Moves and changes.
  - Upgrades.
  - Environmental and operational audits.
  - Consulting and support services.
  - Deinstallation/removal.

- In essence, the user will look toward the service organization for all his needs after initial purchase. Larger organizations and users with a full array of products on an integrated systemic basis have a growing interest in those service organizations that can provide a total service management approach and offer the ability to control and manage this service on a regional and nationwide basis, with a full commitment to response and repair times, and to providing quality service and after-sale support.

- It would also be necessary for those service organizations wishing to participate significantly in the service and support of small systems to establish integrated computerized systems to manage and control full service/processing, including call handling and dispatch, remote diagnostics and technical assistance, management of the data base relating to customer installed base and configuration, and management and control of the logistics pipeline.

- Finally, the service organization must develop a comprehensive, strategic portfolio of service products and develop a service pricing approach strategy that is responsive to both the cost containment interests of certain market segments and the need for highly responsive and quality service of other market segments.

- The size and growth of the small-systems market and the need for integrated service will tend, in the long run, to create significant economies of scale and efficiencies in large, nationwide service organizations servicing an extensive installed base.

- For those organizations with large service functions and a developed service management infrastructure, basic prices for after-sales service, and standard basic prices for installation, maintenance, and repair will drop. These organizations are currently providing installation service at approximately 15% to 30% of acquisition price, and after-sales maintenance at approximately 8% to 14% of acquisition price annually.

- On the other hand, premium prices from the standard service base will increase to provide a closer correlation between the value-in-use needs of the market segments requiring specialized or highly-responsive service, versus market segments that are more interested in cost containment. Smaller organizations attempting to provide national service for manufactured-base small-systems products will be placed at a competitive disadvantage and less efficient service organizations will be forced either to grow through entry into the third-party maintenance market or be divested or acquired by other service organizations that can offer, to the smaller manufacturer, quality service at an economical price.

- In essence, except for highly selective product areas, most of the small systems products in the future will be serviced by large, nationwide service organizations on either a direct or third-party maintenance basis.

- In summary, the primary strategic challenge to the service managers in the small-systems market is to achieve economic and controlled growth through the introduction of integrated service products and the implementation of effective advanced management systems to manage and control the full service process and to maintain tight controls on costs, levels of responsiveness, and service productivity. It will also be critical to introduce market-segment-oriented value-in-use pricing to enable appropriate recovery and return on investment and operating margins.

- For users of small-business systems, an attractive alternative will be offered by third-party maintenance organizations, particularly national third-party service organizations that have established integrated systems to manage and control service dispatch, and to provide technical assistance, remote diagnostics, and software hot-line support.

APPENDIX A: LOCAL-AREA NETWORK MAINTENANCE ISSUES

APPENDIX A: LOCAL-AREA NETWORK MAINTENANCE ISSUES

A. INTRODUCTION

- Local-Area Networks (LANs) provide a method of transmitting information from one point to another within a limited distance, thus allowing shared resources from desk to desk, office to office, and building to building.

- The dramatic growth of microprocessor technology has spurred the use of LANs in conjunction with current office products such as PBXs, personal computers, and word processors, as shown in Exhibit A-1. This growth can be attributed to the cost savings of sharing information processing and data storage resources.

- Currently, due to the lack of standardization of LAN architecture and protocol, compatibility of equipment is an important issue.

- In addition, there is a significant lack of coordination in the areas of planning and implementation as a result of the number of user-planned and user-installed systems.

- As use of and reliance on LANs increase, these issues must be addressed by office product vendors.

EXHIBIT A-1

RELATIVE GROWTH OF SELECTED OFFICE PRODUCTS

OFFICE PRODUCT	1980-1985 GROWTH (percent)
PBX, PABX	400%
Personal Computer (In Large Corporations)	600
Word Processors	400

SOURCE: INPUT Estimates

B. USE OF LOCAL-AREA NETWORKS

- The dramatic growth in LANs is readily apparent, as shown in Exhibit A-1. Users of PBX (PABX) systems, personal computers, and word processors were queried concerning their current use of LANs, as shown in Exhibit A-2.

  - Of all three product types, word processor users use LANs the most (29%). Seventeen percent of the PBX users and 10% of the personal computer users indicated that they use LANs.

  - A surprisingly large number of PBX users did not know if they were currently using a LAN with their system.

C. CONFIGURATION OF LOCAL-AREA NETWORKS

- Users were asked which type of configuration their LAN was. The three commonly used ones are as follows:

  - Star configurations use a central controller connected to each device by cable. The advantage of a star configuration is the simplicity of monitoring and controlling data flow. The disadvantages include high initial cost and the decreased reliability caused by a single point of breakdown. Exhibit A-3 demonstrates a typical star configuration.

  - A ring configuration connects devices by one or more cables in a ring or circular pattern. Since data can flow either direction in the ring, a breakdown of any single device does not affect the entire network. Exhibit A-4 depicts a typical ring configuration.

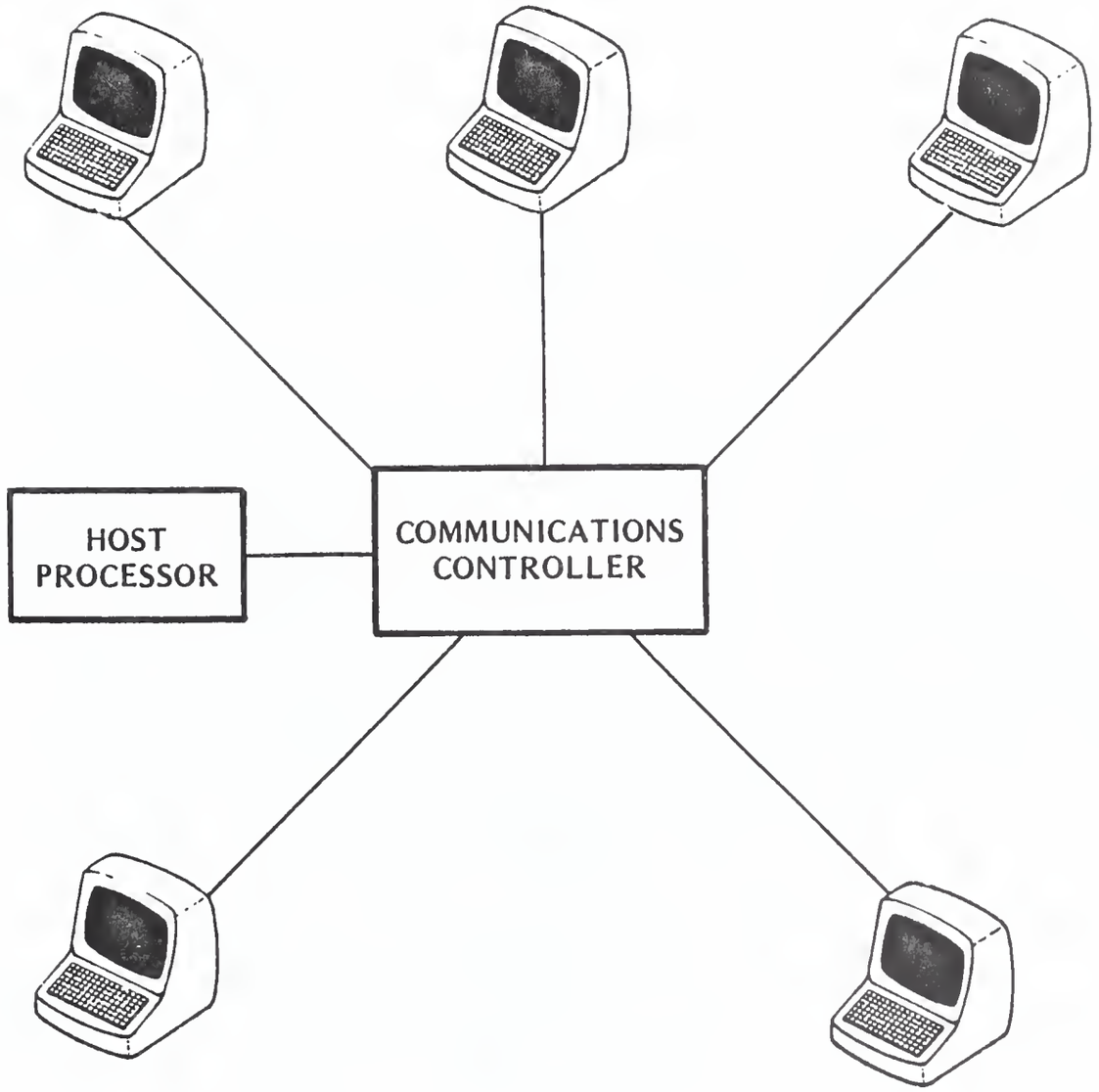
EXHIBIT A-2

USE OF LOCAL-AREA NETWORKS BY PRODUCT

PRODUCT	DO YOU USE A LOCAL AREA NETWORK? (percent)		
	YES	NO	N/A
All Types	10.1%	35.0%	54.9%
PBX, PABX	17.2	31.0	51.7
Personal Computer	9.8	85.2	4.9
Word Processor	28.6	65.7	5.7

EXHIBIT A-3

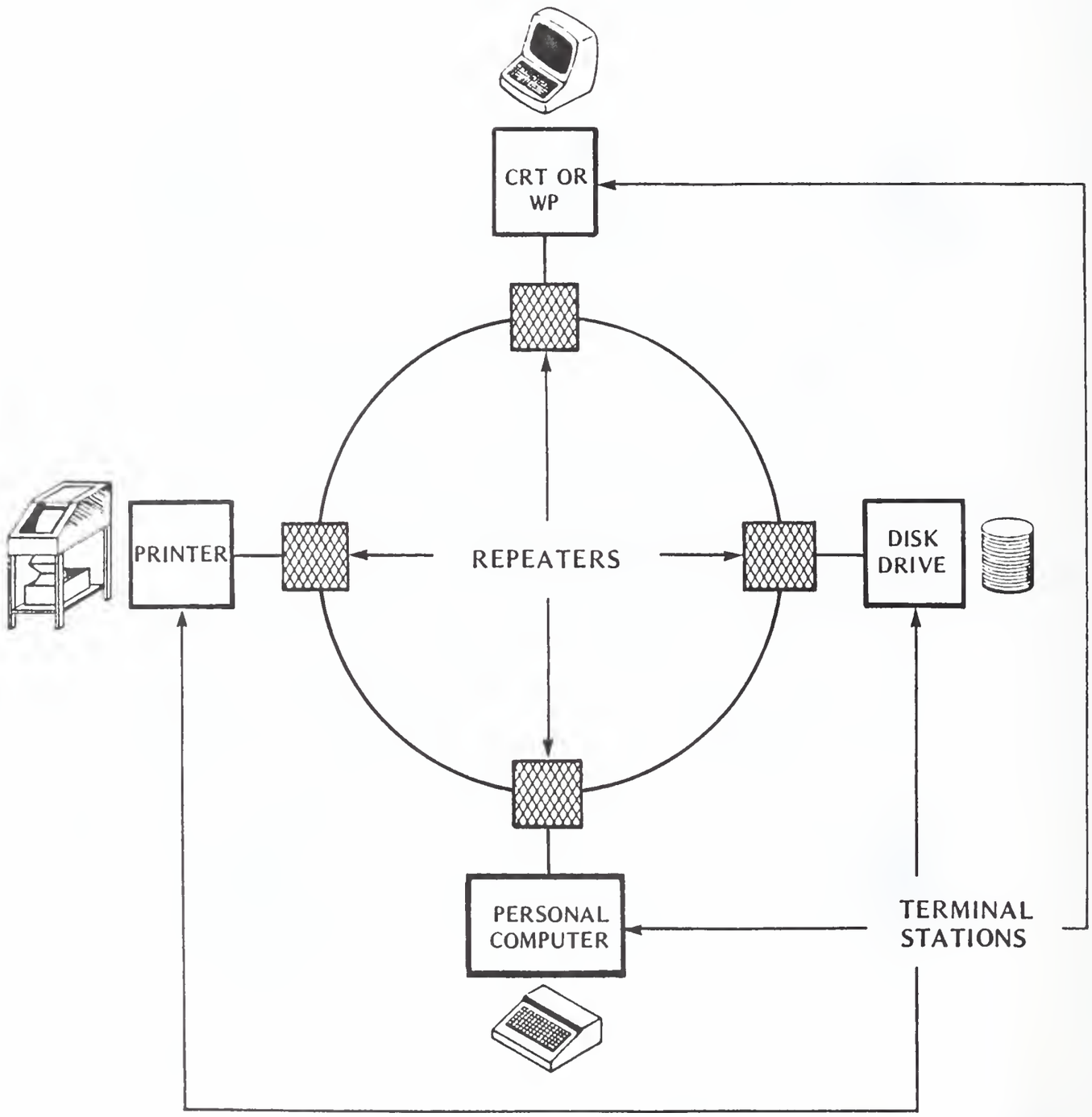
STAR NETWORK CONFIGURATION



= Terminal Stations

EXHIBIT A-4

RING NETWORK



- A bus configuration is comprised of an open-ended transmission line where devices are connected to the cable by taps, allowing data to also flow both directions from any device. Since the configuration is an open-ended line, it is very easy to add new devices. Also, as in ring-configured networks, a single device failure does not affect other devices in the network. Exhibit A-5 depicts a typical bus configuration.

- Exhibit A-6 shows which configurations are used by each product type.

D. FACTORS IN LOCAL-AREA NETWORK MAINTENANCE

- Since users initially turn to networking as a way of increasing resources while reducing overall processing and data storage costs, LAN users will undoubtedly be very price conscious about maintenance.

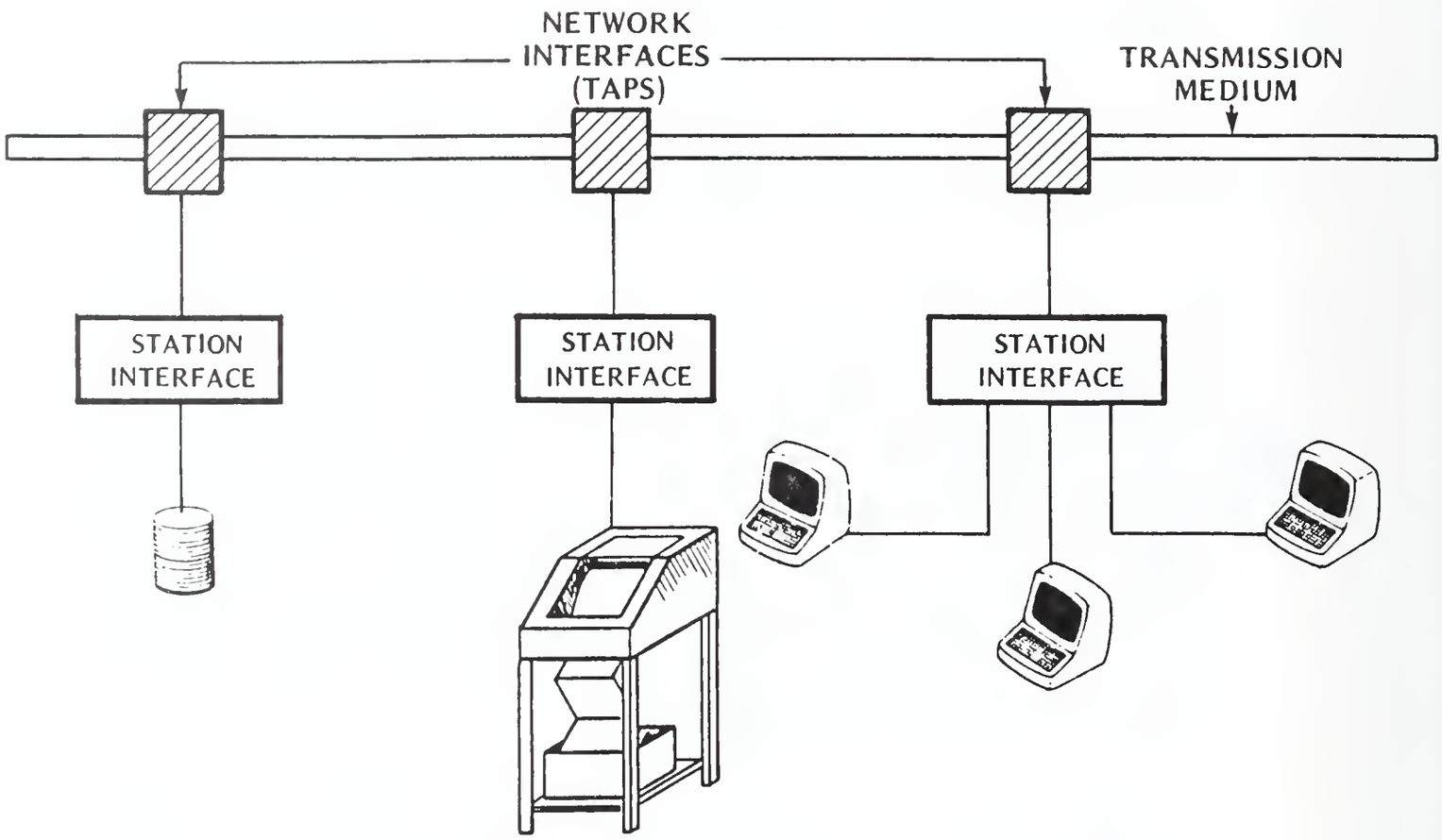
- In addition, LANs will become increasingly integrated into users' information-system structures. This ever-increasing use will cause a burgeoning demand for LAN maintenance. Since users have already expressed a desire for a single source of maintenance, vendors will need to address the issue of providing service on competitive products.

  - The absence of a single source of maintenance has in the past influenced users to provide their own network maintenance. A maintenance management contract would be an ideal solution to this, since vendors would be able to coordinate and control the maintenance of the entire system without additional training of their FEs on competitive products.

  - Another possibility is to combine test equipment with existing computer equipment within the network, which would monitor and diagnose faults within the system.

EXHIBIT A-5

BUS NETWORK



= Terminal Stations (e.g., CRTs or word processors).

EXHIBIT A-6

CONFIGURATION OF LOCAL-AREA NETWORKS BY PRODUCT

PRODUCT	CONFIGURATION		
	STAR	RING	BUS
All Types	81.8%	14.8%	3.4%
PBX, PABX	100.0	-	-
Personal Computer	67.3	-	32.7
Word Processor	76.5	23.5	-

- Vendors should consider network maintenance a growing market in which many revenue opportunities can be realized.

APPENDIX B: QUESTIONNAIRE

A. General Management

1. Please check all of the direct services you currently offer or plan to offer in the near future.

DIRECT SERVICE OFFERED	1983	BY 1985	BY 1987
a) Third-party maintenance			
b) Facility maintenance management			
c) Guaranteed availability (uptime)			
d) Guaranteed response time			
e) Guaranteed repair time (hardware)			
f) On-site standby			
g) Variable shift coverage (versus fixed schedules)			
h) On-site spares			
i) Guaranteed turnaround on software repairs			
j) Remote diagnostics			
k) Preventive maintenance and field changes during nonprime hours			
l) System software maintenance			
m) Application software maintenance			
n) Depot maintenance (pickup)			
o) Depot maintenance (carry/mail)			
p) Local area network maintenance			

2. Please check the ancillary services your field service organization offers or plans to offer in the near future. Also, for those services you currently provide, please indicate the level of quality you believe that your users would give you. (Scale of 1-10: 10 = excellent, 5 = average, 1 = very poor.)

ANCILLARY SERVICES OFFERED	BY 1985	BY 1987	1983	ON A SCALE OF 1-10, USERS WOULD RATE YOU
a) Environmental planning				
b) Physical site planning (layouts)				
c) Consulting services (hardware)				
d) Consulting services (software)				
e) Customer training				
f) Installation management and coordination				
g) Supplies sales				
h) Add-on sales (additional equipment)				
i) Upgrade sales (new equipment or features)				
j) Site audits				
k) Facility relocation				
l) De-installation				
m) Software sales				
n) Ancillary equipment sales and service				

3. How do you rate your field service organization in the following categories, and how do you believe your users would rate you in the same categories? (Scale 1-10: 10 = excellent, 5 = average, 1 = very poor.)

CATEGORIES RATED: (service over the past 12 months)	RATING (1-10)	
	SELF RATING	EXPECTED USER RATING
a) Management's communication with users		
b) Hardware service engineer's communication		
c) Software service engineer's communication		
d) Ability to diagnose hardware problems and to make quality repairs		
e) Ability to maintain software		
f) General responsiveness of the organization to user requirements		
g) Overall service image		
h) Taking initiative to improve user operations		
i) Resolution of invoicing disputes		
j) Dispatching trouble calls		
k) Escalation procedures during extended outages		

4. Please either respond to the following questions or provide us with a functional organization chart (space is provided on the reverse side of this page for your sketch if that is more convenient for you).

FUNCTION	(√) IF NOT FS	TITLE	REPORTS TO (title/function)
a) Top-level field service executive			
b) Top-level domestic line executive			
c) Top international line executive			
d) Field support, general			
e) Field support, hardware			
f) Field support, software			
g) Financial operations			
h) Administration			
i) Logistics			
j) Operations analysis			
k) Education			
l) Personnel			
m) Field service marketing			
n) Engineering liaison			
o) OEM liaison			
p) Legal			
q) Other_____			
r) Other_____			

5. Lower level management and employees are encouraged by some companies to participate in the following activities. Please check those that apply now and in the near future for your company. (Enc. = Encouraged, Mand. = Mandatory.)

ACTIVITIES	1983		1985		1987	
	ENC.	MAND.	ENC.	MAND.	ENC.	MAND.
a) Making good-will calls on users						
b) Selling maintenance contracts						
c) Accompanying sales personnel on sales calls						
d) Attending sales meetings						
e) Furthering formal education						
f) Making public appearances						
g) Joining organizations such as AFSM, Jaycees, etc.						
h) Reading trade journals						
i) Other _____						
j) Other _____						
k) Other						

B. Field Support/Product Support

1. Please rate the trends of the influence of your field service management in the following company activities relative to small systems. (Scale of 1-10: 10 = excellent, 5 = average, 1 = very poor.)

ACTIVITIES	RATING (1-10)		
	1982	1983	EXPECTED 1984
a) Product specification			
b) Product design			
c) Serviceability design			
d) Documentation			
e) Diagnostic development			
f) Selection of test equipment			
g) Spares requirements			
h) Geographic control of sales			
i) Exceptions to standard maintenance agreements			
j) Product performance objectives			
k) Quality control in manufacturing			
l) OEM acceptance criteria			
m) Customer education			

2. Please indicate the level that small system software support has been or will be integrated into the hardware support structure. (0% = no field service responsibility, 100% = fully integrated responsibility.)

SOFTWARE SUPPORT ACTIVITY	PERCENT INTEGRATED			
	1982	1983	1985	1987
a) System control programs at headquarters support level	____%	____%	____%	____%
b) System control programs in the field	____	____	____	____
c) Compilers and system utilities at headquarters	____	____	____	____
d) Compilers and system utilities in the field	____	____	____	____
e) Applications software developed, sold, or distributed by your company - headquarters support	____	____	____	____
f) Applications (as in "e" above) in the field	____	____	____	____
g) Maintenance of third-party software, including user's, at headquarters level	____	____	____	____
h) Maintenance of third-party software in the field	____	____	____	____

3. Please describe your field support or support center structure as it relates to:

   a) User support requirements when users are involved via remote diagnostics.

   b) User support requirements when users are assisted through preliminary stages of problem determination.

3. (Continued)

c) Support of on-site field personnel via telephone and/or remote diagnostics.

_____

_____

_____

_____

_____

d) Physical, on-site support to field personnel (please discuss criteria):

_____

_____

_____

_____

_____

4. Please provide the objectives and actuals in product performance for the most active small systems serviced by your organization.

MODEL NUMBER OR NAME OF MAINFRAMES	MEAN TIME TO REPAIR (hours)		MEAN TIME BETWEEN FAILURES (hours)		AVERAGE AVAILABILITY (percent)		MEAN TIME TO RESPOND (hours)	
	OBJ.	ACT.	OBJ.	ACT.	OBJ.	ACT.	OBJ.	ACT.
a) _____								
_____	___	___	___	___	___	___	___	___
b) _____								
_____	___	___	___	___	___	___	___	___
c) _____								
_____	___	___	___	___	___	___	___	___
d) _____								
_____	___	___	___	___	___	___	___	___
e) _____								
_____	___	___	___	___	___	___	___	___

5. Please check the following items that apply in your field support organization (even if applicable to only one product currently serviced in the field). If not presently implemented, please indicate year scheduled.

	CURRENTLY IMPLEMENTED? YES/NO	YEAR SCHEDULED
a) Remote diagnostics		
b) Centralized dispatching		
c) Modular, plug-in units for user to deliver to repair centers		
d) Real-time incident reporting		
e) Real-time IR (parts usage included)		
f) Signature analysis (field)		
g) Regional repair centers		
h) Third-party repair centers		
i) Third-party on-site maintenance		
j) User support centers		

6. a) What has been the trend in your capital investment in small system spare parts inventories for the years indicated below? Please respond by percentage of gross service revenues derived from support of small systems.

YEAR OF MEASUREMENT	PERCENT OF GROSS SERVICE REVENUES FOR YEAR
1981	%
1982	%
1983 (most recent inventory)	%
1984 (projected)	%
1985 (projected)	%

b) To what most significant factors do you contribute the changes, i.e., growth of installed base, regional spares depots, regional repair centers, reliability of new products, etc.?

Comment:

7. a) Have you announced or have you set a policy on the maintenance and support of local area networks serving competitive products? Yes/No_____

   b) If yes, please comment on your position.

   _____

   _____

   _____

   _____

   _____

   _____

   c) If no, do you have any general comment on the subject of local area networks without making a policy statement?

   _____

   _____

   _____

   _____

   _____

   _____

   _____

C. Financial/Administrative Operations

1. How do you measure changes in field service productivity when measuring the effectiveness of changes in operating methods or investment in capital improvements?

MEASUREMENT METHOD:	YES/NO
a) Ratio of gross revenue carried per field service person per month	
b) Ratio of personnel to equipment by category of equipment	
c) Ratio of personnel to management	
d) Net ratio of expenses to revenue after cost of improvement	
e) Other	

2. What levels of productivity have you realized in servicing small systems for the following? (Please classify measurement using a-e in question 1 above.)

IMPROVEMENT	MEASUREMENT METHOD (a-e)	PRODUCTIVITY IMPROVEMENT (percent)
a) Remote diagnostics		
b) Repair centers		
c) Regional parts depots		
d) Centralized dispatch		
e) Support centers		
f) Field education		
g) Cross training		
h) Multiple territory assignments		
i) Other		

3. Please indicate the percentage of total operating revenues credited to the field service division coming from the following categories. (If fiscal is different from calendar, please supply FY dates.)

SOURCE OF REVENUE CREDITS	PERCENT OF TOTAL REVENUE		
	1982	1983	1984
a) Equipment warranty credits	%	%	%
b) Basic period contracts for maintenance			
c) Extra shift premium			
d) Time and material (labor)			
e) Time and material (parts)			
f) Third-party contracts			
g) Installation charges			
h) De-installation charges			
i) Technical consulting			
j) Management consulting			
k) Parts repairs			
l) Parts sales			
m) Supplies sales			
n) Sales of ancillary equipment			
o) Maintenance of ancillary equipment			
p) Sales of software products			
q) Maintenance of software products			
r) Revenues from other divisions			
s) Other _____			
t) Other _____			
u) Other _____			

4. Please indicate the percentage of total field service division expenses in the following categories (and supply FY dates if different from calendar year).

EXPENSE LINE ITEM	PERCENT OF TOTAL EXPENSES [use ( ) to indicate credit]		
	1982	1983	1984
a) Basic direct labor, wages, salaries			
b) Direct labor overtime shift premiums and standby pay			
c) Support personnel salaries			
d) Management and administrative salaries and premiums			
e) Benefits programs			
f) Net parts usage			
g) Inventory variances			
h) Depreciation			
i) Travel (includes auto leases)			
j) Relocation			
k) Education			
l) Equipment rental/lease			
m) Office, warehouse space			
n) Communications			
o) Interdivisional transfers			
p) Logistics, repair depot, and other expenses not reported above			
q) Corporate general and administrative allocation (overhead)			
r) Other significant categories			
_____			
_____			

5. Please check any of the following interdivisional transfers of revenues and expenses between your field service division and other departments, and indicate whether they are treated as revenue or expense items by checking the appropriate columns. (Check all columns that apply.)

INTERDIVISIONAL TRANSFERS OF ITEMS	REVENUE (FE)		EXPENSE (FE)	
	CREDIT (✓)	DEBIT (✓)	CREDIT (✓)	DEBIT (✓)
a) Warranty of equipment				
b) Spare parts used during warranty				
c) Direct labor during warranty				
d) Sales assistance				
e) Maintenance sales commissions				
f) Manufacturing assistance				
g) Engineering assistance				
h) Extended warranties				
i) Nonstandard contract terms, e.g., on-site engineers				
j) Defective spare parts				
k) Sales changes to equipment				
l) Saftey changes				
m) Engineering changes				
n) Other _____				
_____				
_____				

6. Please supply the figures as indicated for your overall financial performance (indicate fiscal year if different from calendar year).

FINANCIAL PERFORMANCE	FISCAL YEAR END _____			
	1982	1983	1984	1987
a) Field service revenue ($ millions)				
b) Field service expenses ($ millions)				
c) Pretax profit (percent)				
d) Revenue per field service engineer (direct labor)				
e) Direct expense per field service engineer (direct labor)				
f) Fully burdened expense per field service engineer (direct labor)				
g) Basic hourly rate charged for service				
h) Fully burdened field service expense per field service employee (all categories)				

7. Please comment below on service to remote customers: zone charges, response times, etc.

a) Zone definitions:

Primary zone 0 – ___ miles

Zone 2 ___ – ___ miles

Zone 3 ___ – ___ miles

Other criteria: _____

b) Zone premiums added to basic maintenance charges: _____

c) Response time targets for zones: _____

d) Other comments: _____

8. a) Please describe the methodology your company uses to set small system maintenance prices (percent of purchase tested against cost of service projection, etc.):

_____

_____

_____

_____

_____

b) At what ratio of basic maintenance price to list price do you believe that:

i) Small system users will actively consider alternative sources	____ %
ii) Small system users will definitely contract third party or maintain own equipment	____ %
iii) Users will refuse to buy the original product, given the option	____ %

c) How frequently have you and do you expect to change prices of maintenance for:

	FREQUENCY OF CHANGE (months)			
	1982	1983	1984	1985
i) Small systems	_____	_____	_____	_____
ii) Basic hourly rates	_____	_____	_____	_____
iii) Shift differential	_____	_____	_____	_____

d) Do you offer discounts for:

	PERCENT DISCOUNT
i) User assistance in remote diagnostics	____ %
ii) User replacement of plug-in modules or units	____ %
iii) User delivery of plug-in modules or units to repair center	____ %
iv) Relaxed requirement on response time	____ %
v) User purchase of spare parts kits	____ %
vi) Other: _____	____ %

9. Contract administration:

   a) Are your maintenance contracts: (i) automatically renewed_____or (ii) negotiated each renewal cycle?_____

   b) What is the length of your normal contract?_____(months)

   c) Do you normally invoice (i) monthly_____, (ii) quarterly_____, (iii) semiannually_____, (iv) annually_____, (v) other_____ .

   d) Do you invoice for exceptions (time and material, etc.) at a different time than your normal cycle? Yes/No_____If yes, please describe:

   _____

   _____

   _____

   _____

   e) Who is responsible for maintenance contract:

      i) Negotiation_____

      ii) Renewal_____

      iii) Administration_____

10. a) Has your field service division implemented a field quality assurance program or other formal operational audit? Yes/No _____

    b) If yes, please describe: _____

    _____

    _____

    _____

    _____

    _____

    _____

    _____

11. What is the average cost breakdown of a typical fault call? (Please respond for products your company services.)

PRODUCT SERVICED	TOTAL COST (dollars)	DIRECT LABOR (percent)	TRAVEL (percent)	PARTS (percent)	OVERHEAD & SUPPORT
Large mainframes					
Medium mainframes					
Small systems					
Peripherals					
Terminals					
Word processors					
Personal computers					
Copiers, facsimile					
Work stations					
PABX, PBX					
Teleprocessing/communications					

D. Personnel

1. Please identify your sources of new employees and rate them on a scale of 1-10. (1 = little or no importance, 10 = highest importance.)

SOURCE OF NEW EMPLOYEES	RATING (1-10)			
	1982	1983	1984	1987
a) Competition				
b) Trade schools				
c) Military schools				
d) Two-year college programs				
e) Four-year colleges				
f) Apprenticeship programs				
g) Other division in company				
h) Employee referrals				
i) Headquarters				
j) Other: _____				

2. Do you provide in-company formal training for:

	YES/NO
a) Indoctrination	
b) Basic training (apprentice level)	
c) Product (technical)	
d) Systems software (system)	
e) Applications software	
f) Management development	
g) Technological upgrading	

3. Do you fully (F) or partially (P) reimburse or otherwise provide financial support for:

	F/P
a) University courses	
b) Out-company seminars in management development	
c) Professional association membership	
d) Purchase of company stock	
e) Professional trade journals	
f) Matching grants to educational institutions	
g) Children's higher education	
h) Out-company training in professional (technical) development	
i) Nonexempt employee relocation	
j) New-hire relocation	
k) Exempt employee relocation	
l) Lease or purchase of automobiles to be used for business	
m) Lease or purchase of company products (micros, minis, personal computers, typewriters, etc.)	
n) Other: _____	
_____	
_____	

4. Do your personnel policies and procedures provide for the following employee benefits and assurances? (Y/N)

FRINGE BENEFITS	EXEMPT		NONEXEMPT	
	1983	BY 1985	1983	BY 1985
a) Life insurance				
b) Hospitalization				
c) Major medical (80% or better)				
d) Limited medical (out patient)				
e) Dental				
f) Eyesight/glasses				
g) Retirement				
h) Disability insurance				
i) Matched savings				
j) Profit-sharing				
k) Paid sick leave				
l) Grievance procedures				
m) Improvement programs for marginal performers				
n) Exit interviews				
o) Appraisal and counseling				
p) Career path definitions				
q) Pay for performance guidelines				

5. Does your company provide incentives for field service employees? (Indicate by check mark.)

INCENTIVES	MANAGEMENT		EXEMPT		NONEXEMPT	
	1983	BY 1985	1983	BY 1985	1983	BY 1985
a) Stock options						
b) Performance bonuses						
c) Suggestion awards						
d) Periodic recognition awards ("FE of the quarter," etc.)						
e) Special projects, foreign assignments, etc.						
f) Award conferences, trips						
g) Competitive scholarships for employees or family						
h) Other: _____						
_____						
_____						

6. a) How many direct labor field service personnel were hired in the following years?

1982 _____

1983 _____ (forecast)

1984 _____ (forecast)

b) How many direct-labor field service personnel left your company in:

1982 _____

1983 _____ (forecast)

c) What percentage of the persons leaving leave for the following reasons:

	1982	1983
i) Voluntary, no reason given	%	%
ii) Left for higher salary, better total compensation		
iii) Released for company reasons		
iv) Promotion in another company		
v) Relocation by another company		
vi) Promoted within own company		
vii) Transferred to foreign subsidiary or other division		
viii) Other _____		
Total	100%	100%

d) Staffing levels:

U.S. EMPLOYEES	1983	1984
i) Total employees in company		
ii) Total in field service division		
iii) Number of direct-labor FEs		
iv) Number of field support engineers		
v) Number of field supervisors		
vi) Number of managers in field		
vii) Line managers at headquarters		
viii) FE staff managers (total)		
ix) FE staff personnel (nonmanagement including administration)		

7. 1983 annual salaries, small system field engineers (front-line product field service technicians)

JOB DESCRIPTION	TITLE	(✓) EXEMPT	NUMBER IN U.S.	RANGE		AVERAGE PAID (actual)	AVERAGE GAIN OVER 1982 (percent)
				MAXIMUM	MINIMUM		
a) Entry-level trainee for hardware maintenance		( )					%
b) Entry-level trainee in software maintenance		( )					%
c) Minimum experience level qualified to respond to trouble calls, generally requires assistance		( )					%
d) Qualified field service technician carries territory, requires occasional assistance, renders some aid to lower levels		( )					%
e) Senior-level field service technician: generally gives more assistance than received, assigned field training duties to assist in development of first two categories (above)		( )					%
f) Qualified field service engineer in software support		( )					%
g) Senior level software support in field							
h) Top-level hardware specialist located in field office		( )					%
i) Top-level software specialist located in field office		( )					%

8. 1983 annual salaries, field office staff personnel

JOB DESCRIPTION	TITLE	(✓) EXEMPT	NUMBER IN U.S.	RANGE		AVERAGE PAID (actual)	AVERAGE GAIN OVER 1982 (percent)
				MINIMUM	MAXIMUM		
a) Repair depot, repair technician trainee		( )					%
b) Repair depot, repair technician		( )					%
c) Senior-level repair depot technician		( )					%
d) Office administrator, Jr.		( )					%
e) Office administrator, Sr.		( )					%
f) Field service supervisor may work approximately 50/50 on equipment and management		( )					%
g) First-line manager of field service engineers		( )					%
h) Second-line manager located in field offices		( )					%
i) Staff manager in education and field support		( )					%
j) Staff manager in operations and financial analysis		( )					%
k) Field service administration manager		( )					%
l) Field service personnel manager		( )					%